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THESIS

CONCEPT DEVELOPMENT OF A
MANPOWER PROGRAMMING AND BUDGETING SYSTEM FOR
HEADQUARTERS, UNITED STATES MARINE CORPS

by

Kevin M. French

March 1985

Thesis Advisor:	Norman Lyons
Co-Advisor:	Thomas G. Swenson

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ABSTRACT (Continued)

Requirements Statement, Feasibility Study, and Economic Analysis
were produced.
The recommendation was to continue development and begin the
Detailed Design phase of the system life cycle. The recommended
alternative was for a distributed architecture comprised of
microcomputers linked by a local area network to provide resource
and data sharing. Access to a mainframe processor for support of
large database functions will be provided by leased communica-
tions lines and remote terminal sessions using the microcomputers
The importance of a high level information resource management
plan was stressed for successful implementation.

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Concept Development of a
Manpower Programming and Budgeting System for
Headquarters, United States Marine Corps

by

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Captain, United States Marine Corps
B.S., University of Dayton , 1979

Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

This paper documents a Concept Development Phase analysis conducted for the Manpower Plans, Programs, and Budget Section of Headquarters, U. S. Marine Corps. The study fulfills the requirements of Marine Corps Order P5231.1, Life Cycle Management for Automated Information Systems (LCM-AIS). The study analyzed the users' functional requirements and produced documentation required for Concept Development of a Marine Corps Class II automated information system. A Mission Element Need Statement (MENS), Requirements Statement, Feasibility Study, and Economic Analysis were produced.

The recommendation was to continue development and begin the Detailed Design phase of the system life cycle. The recommended alternative was for a distributed architecture comprised of microcomputers linked by a local area network to provide resource and data sharing. Access to a mainframe processor for support of large database functions will be provided by leased communications lines and remote terminal sessions using the microcomputers.

The importance of a high level information resource management plan was stressed for successful implementation.

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I. INTRODUCTION

A. BACKGROUND

The purpose of this paper is to conduct a Concept
Development Phase analysis of an automated information
system for an organization within Headquarters, United
States Marine Corps.

The Manpower Department of Headquarters Marine Corps is
responsible for coordinating the development and submission
of Manpower budgets and programs to support Marine Corps
missions. Facets of manpower management and planning
processes are currently being automated and upgraded.
Before this, the manpower budgeting and programming
functions of the Manpower Department have lacked attention
to the need for automated processing.

The Manpower budget accounts for approximately 40 per
cent of the total Marine Corps operating budget. Most of
this amount is stable and predictable. A significant
portion (around 35 per cent) of the Manpower budget goes for
paying marines who are not actually filling billets in any
organization. These are accounted for in the so-called
overhead accounts. They are comprised of those marines in
one of the following statuses: Patient, Prisoner, Transient
or Trainee. These personnel must be budgeted as a separate
line in the Marine Corps manpower budget.

B. PURPOSE

The Manpower Department decided that closer control
should be kept of these and other manpower budget costs. It
was decided that a study should be conducted to define
Manpower programming and budgeting requirements to outline

deficiencies in the present methods of doing business and
suggest possible courses of action. The Manpower Procedures
and Integration Section was directed to carry out the duties
of Project Manager for the system development.

C. METHODOLOGY

Information was gathered during two visits to the users'
place of business in July and September 1894. A total of
seven days was spent on-site gathering data, conducting
interviews and observing the work environment. All users
were interviewed as were representatives from the requesting
office, Manpower Procedures and Integration Section (Code
MPI-40).

The study was conducted under the guidelines of [Ref. 1]
and [Ref. 2] and constitutes the satisfaction of the
requirement to conduct a Concept Development effort and
produce the associated life cycle management documents. It
is, by definition and intent, a general assessment of the
present and required functions and capabilities of the
users. The Concept Development phase as prescribed in
[Ref. 2: p. 3-3] is not intended to be a detailed design
specification. Detailed design commences after the
validation of user requirements and operational and
technical feasibility.

The chapters of this paper parallel the Life Cycle
Management documentation required by [Ref. 2]. The contents
of the chapters themselves mirror as closely as possible the
required information to be contained within each document.
Some repetition is unavoidable. The intent is that
requirements and deficiencies begin to emerge in greater
detail as the analysis progresses. A point to remember is
that all documentation produced in this methodology is
updated as the project moves through the development phases.

D. TERMINOLOGY

To provide a better flow of logic within the body of the paper, definitions to key phrases were kept to minimum. Appendix &gloss contains a glossary of terms used in this paper which are unique to this subject. [Ref. 3: p. C-1] constituted the basis for this glossary, which has been annotated as appropriate for the purposes of this study.

II. MISSION ELEMENT NEED STATEMENT (MENS)

A. MISSION AREA IDENTIFICATION

The organization that is the subject of this study is an element of the staff of Headquarters, United States Marine Corps. It falls under the general control of the Deputy chief of Staff, Manpower. Figure 2.1 shows the organization of the major departments of Headquarters, U. S. Marine Corps.
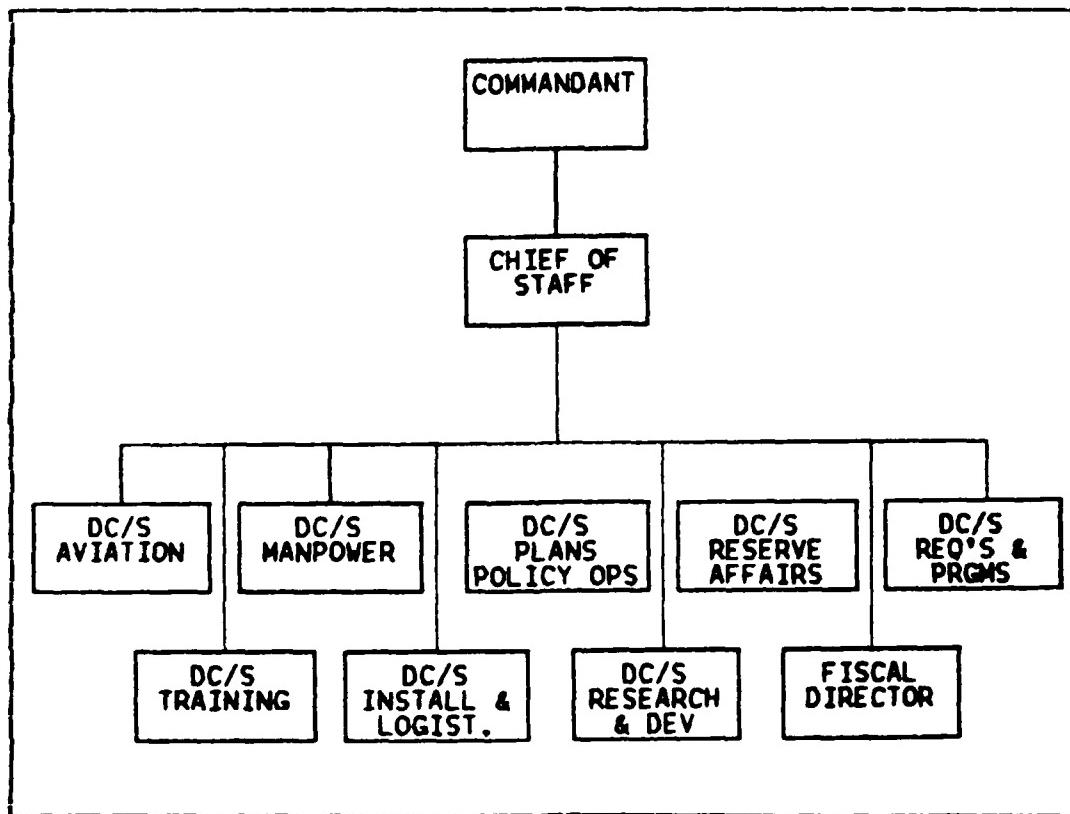
Figure 2.1   Headquarters Marine Corps Organization Chart

The complete descriptive title of the user organization is the Plans, Programs and Budget Section; Manpower Policy, Planning, Programming and Budgeting Branch; Manpower Plans and Policy Division; Manpower Department. Hereafter, it will be referred to by the short title MPP-40. Figure 2.2 shows the position of MPP-40 within the Manpower Department. It is located along with the rest of the headquarters staff in the Navy Annex Building, Arlington, VA.

The mission of MPP-40 is to prepare manpower plans and programs in support of the Marine Corps Planning, Programming and Budgeting System (PPBS) and to prepare, support and justify Marine Corps manpower budgets, statistics and plans in support of the Military Pay, Marine Corps (MPMC) appropriation. Authority for this mission is contained in [Ref. 4: p. 2-16].

1. Current Environment

The Budget and Programs Units are smallest elements within MPP-40. Figure 2.3 shows how MPP-40 is organized to carry out its mission. It is manned by five action officers and four civilian budget analysts. The two units, together with the Plans unit comprise the Plans, Programs and Budget Section of the Manpower Policy, Planning, Programming and Budgeting Branch.

The following are specific tasks which are performed by MPP-40.

1. Coordinate the development and preparation of manpower data and budget analysis in support of Marine Corps participation in the PPBS.

2. Coordinate, validate, and authorize release of all Manpower statistics and related reports to agencies external to the Marine Corps.

3. Maintain historical data on strengths, distribution, promotions, and related subjects to support manpower plans and prepare manpower budgets.

4. Act as liaison with agencies outside the Marine Corps which have a requirement for manpower data.

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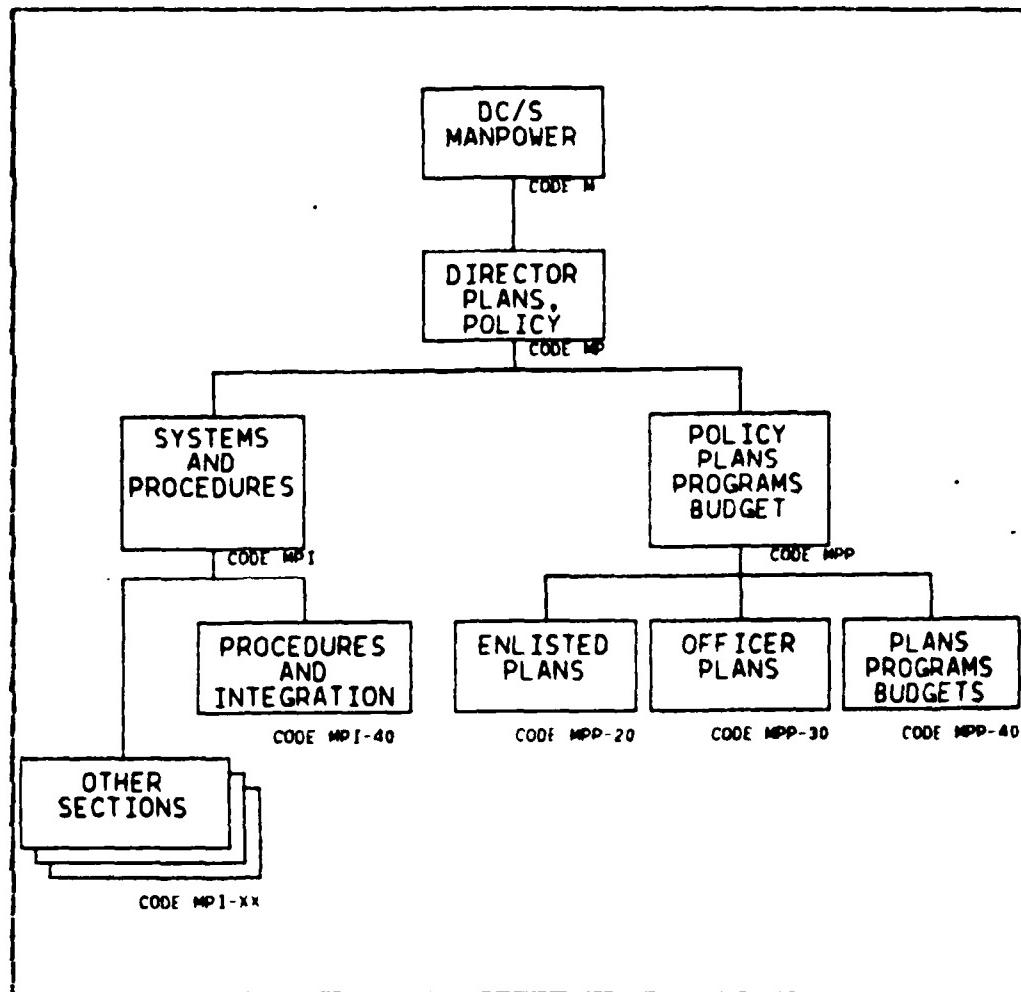
Figure 2.2   Major Divisions of the Manpower Dept.

5. Prepare military manpower budget estimates
    associated with various management alternatives
    in support of PPES.

6. Supervise and review the execution of manpower
    programs and the MPMC budget.

7. Use the projections and estimates from the Table
    of Manpower Requirements(T/MR) and Troop List to
    prepare programs and budget estimates.

8. Prepare the Five Year Defense Plan (FYDP) and
    Manpower Requirements Report.

9. Prepare manpower statistics, reports, analyses
    and budgets.

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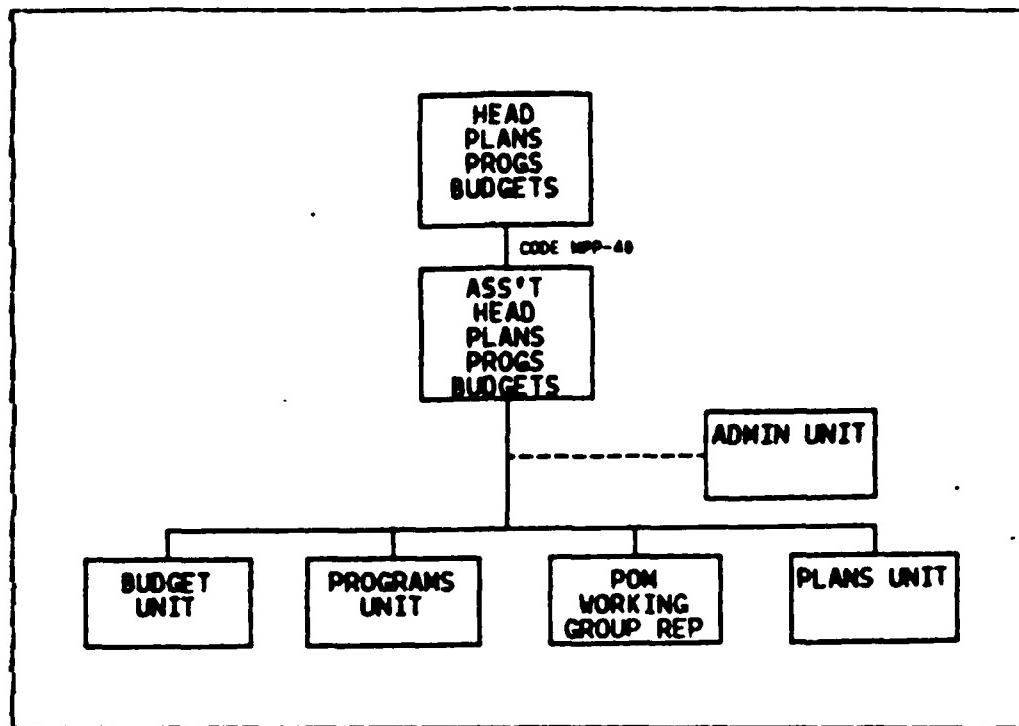
Figure 2.3   Plans, Programs and Budget Section, MPP-40

10.   Estimate average man-years and dollar costs for
the manpower overhead accounts, Patients,
Prisoners, Transients and Trainees T2P2[1] for the
Five Year Defense Plan (FYDF).

Nearly all the activities associated with the
above tasks are performed manually with the use of
spreadsheets and desk top calculators.   Automated
reports from MMS and HMF are manually verified,
corrected and then updated and prepared in final form.
Many of the tasks are cyclical (usually monthly) or
repetitious in nature.   There are also ad hoc requests
for information from agencies outside the Marine Corps

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[1]Marines in this category must be budgeted for
aside from those who actually fill billets.   Permanent
Change of Station costs are budgeted under this
category which traditionally bears considerable
scrutiny at all levels of oversight.

and the Department of Defense which occur with
unpredictable frequency.

There are several automated systems currently
being developed with which the section will have to
interface, either providing inputs or using their
output. They are the Officer Planning System,
Enlisted Planning System, Automated Troop List, Table
of Manpower Requirements and Navy Headquarters
Programming System and Budgeting System (NHPS/BS).[2]

2. Priority

The mission outlined in this MENS has a high
priority relative to the other mission needs of the
organization. The successful preparation of programs
and budgets for the Manpower Department, their
justification to higher authorities and the monitoring
of their execution is a crucial function at the
headquarters level. Successful execution depends on
rational, efficient and correct mission performance by
the sections. To properly function in an increasingly
competitive and complex budgeting and planning arena,
the Marine Corps needs to fully exploit all information
resources at its disposal.

B. DEFICIENCY

1. Scope

Several problems exist with the methods which
the Budget and Plans Units must use to gather, process

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[2]These are manpower systems which are used to
prepare plans and forecasts based on current and
programmed structures of the Corps. NHPS/BS is a Navy
sponsored system scheduled for implementation in fiscal
year 1986. It will provide the means to satisfy Navy
budget reporting requirements.

and store data for use in their programs, budgets and reports.

There is a lack of integration of the output of the Officer and Enlisted Planning models and the programming and budgeting process. Output from the models must undergo manual verification, reformatting and editing to be useful to the Programs and Budget units.

The dynamic nature of the POM process causes the budgetary impact of many alternatives to be manually calculated numerous times. Programs and policies are proposed and routinely modified, which causes recalculation of their impact.

There is a lack of an efficient, reliable method with which to monitor actual manpower statistics on a monthly basis. The reports containing information about the manpower levels from the HMF extracts are often inaccurate and unreliable. They must be edited and cross checked with other reports. The information they contain must be transcribed onto spreadsheets so that it may be used for calculations, management reports and stored.

Manpower statistics from prior years are not stored in a readily accessible format for analysis. The information is stored on large spreadsheets. Because of this it is difficult to work with them them. Data must be transcribed onto other working spreadsheets whenever new calculations or analysis is done. This is laborious and error prone.

Redundancy in reports required by outside agencies causes repetitive manual preparation of the same data in different formats. Many of the data elements are repeated in different reports. It is merely presented in different formats and sent to different agencies.

There is inadequate storage space for the
hardcopy records and working papers. Working spaces
are extremely cramped. There is not adequate room for
proper storage of the numerous records which must be
kept in perpetuity.

There is no method for analysts to do
statistical analysis on the data from prior years
without excessively time consuming manual calculations.
Once the historical statistics are gathered, all
analysis and manipulation is done manually with the
aide of desktop calculators. There are no tools with
which to perform even elementary statistical analysis.

Present methods of data extraction from the
Headquarters Master File (HMF) and Manpower Management
System (MMS) are not responsive to the changing
requirements of the users' environment. The methods
are mostly batch oriented inflexible programs which are
not easily modified to allow changes in either format
or content.

The method used to forecast the T2P2 accounts
is intuitive, not quantifiable. There is no way to
calculate with reasonable confidence the rates and
costs for future years given changes in manpower
policies and programs. The present method uses a
simple weighted average to spread the costs of the
overhead accounts among grades and across programs.
The basis for this method is that it is the most
objective method available. It does not provide the
accuracy or detail required.

2. _Jobs_ _to_ _be_ _Accomplished_

The functional outcomes to be accomplished
include the following:

1. A method for users to access MMS and HMF files
   and to edit and validate the information that

they contain so that it may used to prepare management reports and analyses.

2. A method to efficiently and reliably determine actual monthly manpower statistics.

3. The ability to produce required reports without redundant manual and automated processing.

4. Appropriate storage facilities are required for historical data for ease of retrieval and physical security.

5. A method to reliably forecast the overhead accounts for (T2P2) programming and budgeting purposes.

6. A method to explore the program and budgetary impact of management options in terms of force structure or manning issues, i. e., "what if" or gaming capabilities.

C. EXISTING AND PROGRAMMED CAPABILITIES

1. Current Capability

The units currently rely heavily on manual calculations to perform program, budget and statistical analysis. Output from models and files are manually transcribed into the required formats so that the information they contain can be validated and put in useful formats. A Hewlett-Packard minicomputer is used to do limited data manipulation, file maintenance, and graphics. Electronic word processing is used to convert manually prepared reports and computations into smooth documents.

The programmed capability to address the above deficiencies is the design, development and implementation of an integrated system of data extraction, and data manipulation and analysis tools to enhance the unresponsive automated support currently available. Development will proceed under the guidelines of [Ref. 2: pp. 1-12 - 14]. Development will be accomplished in phases over the next two years [Ref. 5: p. 2].

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2. Impact

Programming and budget analysis will not be able to increase in sophistication or efficiency until laborious manual procedures are eliminated and the unreliable, inflexible automated portions are remedied. Manpower programming and budget analysis will be of reduced quality from that which is desirable and attainable. Analysts will continue to do excessive clerical work at the expense of fruitful labor.

Increasing congressional interest in manpower budgets is likely to cause a demand for more in-depth analysis not currently available in the present manually driven system. The pressures brought on by projected reductions in the recruit pool in the near term may cause the Marine Corps to require even closer analysis and monitoring of its manpower resources in the approaching scarce resource market. The present system will not allow for an increase in the depth of the analysis of the available information.

D. CONSTRAINTS

1. Standardization

The system must be able to access existing Marine Corps databases and file structures.

The system must be written in a *DoD* approved language and conform to *DoD* and *USMC* automated information system standards and orders.

The proposed solutions must use to the maximum extent feasible existing automated manpower systems.

2. Interfaces

There are automated systems currently under development by the Marine Corps which will provide inputs for the proposed system (Officer Planning System, Enlisted Planning System, Automated Troop List and the enhancements of the Table of Manpower Requirements). In addition, the Marine Corps has opted to participate fully with the Navy Headquarters Programming and Budgeting Systems currently under development. These systems will provide an automated processing and input system for transmitting budget data to the Navy Comptroller (NAVCOMPT). Alternative solutions must be compatible with these current and developing systems.

NHPS/BS will require automated submission by an input terminal of budget data to NAVCOMPT via a local area network. Any proposed system must consider this interface so that internal budget and program development is able to efficiently interface with NHPS/BS.

E. PROJECT MANAGEMENT

Project management for the system will be the responsibility of the Manpower Management Systems Integration and Procedures Section (MPI-40). Staff concurrence will be through the user, Plans, Programs and Budget Section (MPP-40). Staff concurrence and coordination will be made through all organizations that are developing systems with which the planned system may be required to interface. Approval authority to proceed past project milestones rests with the Deputy Chief of Staff for Manpower. [Ref. 5: p. 3]

III. REQUIREMENTS STATEMENT

A. GENERAL

1. Purpose

The purpose of this requirements statement is to provide documentation that may be used to establish user requirements for the Manpower Programming and Budgeting System. It also is a vehicle for the Marine Corps to evaluate the need for an automated system and then to proceed to the concept development phase of the system development life cycle.

This requirements statement is intended for review by the current and potential users of the MPBS as well as those who will be responsible for the technical support of the system and other appropriate USMC managers. This document is prepared in accordance the format specified in [Ref. 2: p. D-1].

B. CURRENT SYSTEM

1. Project References

Information and authority regarding the continued development of this system is found in [Ref. 2] and [Ref. 5].

2. Existing System

a. Mission

The mission of the Plans, Programs, and Budget Section (MPP-40) is to prepare manpower plans and programs in support of the Marine Corps Planning Programming and

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Budgeting System (PPBS) as reflected in the Joint Strategic
Planning System, Marine Corps Planning System, Program
Objective Memoranda (POM), the Five Year Defense Plan
(FYDP), and the various Military Personnel, Marine Corps
(MPMC) and Operations and Maintenance, Marine Corps (O&M,MC)
budget submissions.

The functions of the Programs and Budget Units
pertain to the planning, coordination, development and
execution of the programs and budgets for the Military Pay,
Marine Corps appropriation.

The Programs Unit is responsible for the
preparation and adjustment of the Five Year Defense Plan
(FYDP), preparation of management reports and calculation of
Transients, Trainees, Patients and Prisoners (T2P2)
estimates for the outyears of the FYDP. The unit is also
the functional sponsor of the Tables of Organization for
those Marines who are not assigned to duty within the Marine
Corps proper.[3]

The Budget Unit prepares manpower budget
estimates and justifications to support Military Pay, Marine
Corps (MPMC) appropriation. It develops rates for
longevity, dependency and clothing allowances. It manages
Manpower's participation in the budget review process
conducted by the Department of Navy, Department of Defense,
the Executive branch and the Congress. It prepares
management reports concerning the status of the current
manpower environment.

   b. Personnel

The Progams and Budget Units are composed of
five officers and three civilian budget analysts. In
addition, there is the Head, Plans, Programs and Budget

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   [3]For example, those who are serving with the Department
of State or other federal agencies.

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Section and the Assistant Section Head. Clerical support is
provided by an administrative assistant. The two units,
together with the Plans unit comprise the Plans, Programs
and Budget Section of the Manpower Policy, Planning,
Programming and Budgeting Branch. See Figures 2.2 and 2.3.
The Plans unit does not have a requirement for programming
or budgeting capability.

The following is a list of personnel presently
assigned to the Programming and Budget Units:

1. Force Structure Analyst
2. Operations Budget Officer
3. Programs Officer
4. Program Analyst
5. Officer Budget Officer
6. Officer Budget Analyst
7. Enlisted Budget Officer
8. Enlisted Budget Analyst

These people are supervised by the Head of the Plans,
Programs and Budgets Section.

The spaces for all personnel are located in Room
4326 of the Navy Annex. The work spaces are extremely
crowded. All work and storage spaces are at a premium.

c. Functional Responsibilities

We turn now to a description of the general
functional responsibilities of the users. A data flow
diagram appears as Figure 3.1. The data flow diagram
identifies major processes which MFP-40 performs and depicts
the flow of data between them. It is independant of the
physical means by which the processes are carried out
[Ref. 6: p. 25]. A description of the major processes
follows.

(1) <u>Gather</u> <u>Data</u> <u>for</u> <u>Analysis</u>. Gather data
from sources such as T/MR, Troop List, Manpower Management
System, and Headquarters Marine Corps organizations to
include Staff Judge Advocate, Aviation, Training, and
Requirements and Programs Departments. Automated reports
are a main source if data about personnel. The analyst may
have to request special reports or manually reformat data
that is received in order to make use of it.

(2) <u>Validate</u> <u>and</u> <u>Store</u> <u>Data</u> <u>and</u> <u>Reports</u>.
Store and validate historical data that has been gathered on
actual manpower strengths, distribution of grades and years
of service, promotions, and related subjects to support
manpower plans and prepare manpower budgets. Storage
involves all documents produced such as budget proposals,
budget submissions, POM initiatives and management reports.
Validation may require that data in several reports be cross
checked by inspection, manually cross totalling categories,
or analyzed based on prior experience for validity.
Reporting or data extraction anomalies often cause reports
to contain bad data which must be manually corrected. This
process normally involves the posting the data to large
spreadsheets so that it may be manipulated.

(3) <u>Prepare</u> <u>Reports</u>. Prepare and present
management reports concerning strengths, accessions,
reenlistments, promotions, losses and manpower costs.
Prepare ad hoc reports and briefs on matters of current
interest to Manpower officials and senior Headquarters
Marine Corps staff. After data has been validated, it must
be transcribed again to be put in the proper format for
reports. Depending on the report this step usually involves
a final transformation when the rough is given to the
administrative assistant for word processing.

The section also compiles manpower witness
statements for hearings before congressional committees
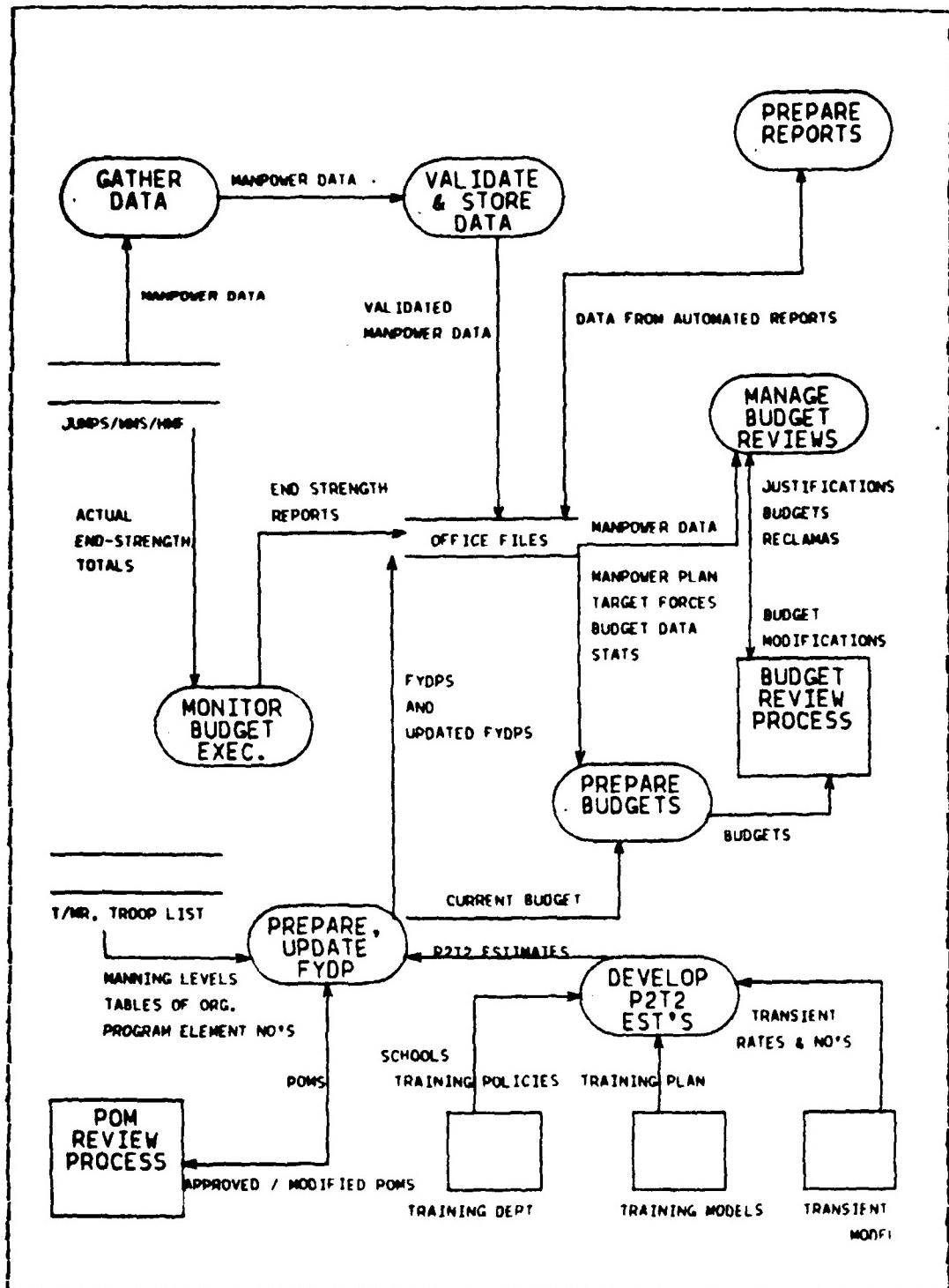
Figure 3.1   Data Flow Diagram of Major Processes

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which pertain to military manpower. These are prepared statements for senior officials whc must testify.

(4) **Prepare Five Year Defense Plan.** Current year and outyears of the FYDP are updated based on the approved PCM initiatives. Estimated manyears are broken down by defense program numbers for each of the five years of the FYDP. In addition, the Individuals account is detailed to show the projected manyears for Patients, Prisoners, Transients and Trainees. Changes in the FYDP outyears due to modifications stemming from the POM process are made.

(5) **Prepare Budgets.** Budget estimates are prepared and submitted throughout the year. They are submitted to the Navy, Department cf Defense and Office of Management and Budget. Changes directed by these approval authorities are made by MPP-40. Budget preparation includes the supporting documentation required as background and substantiation by the approval authorities. Manpower plans for Officers and Enlisted which prcject promotions, accessions and releases, the FYDP, and projected manning levels are used to prepare the manpower budgets. They also develop clothing allowance estimates based on clothing costs and estimated enlisted manyears. The costs of Special Duty pays for certain skills and hazardous duty is also budgeted here.

(6) **Manage Manpower Budget Review Process.** MPP-40 manages the Manpower Department participation in the MPMC budget review process conducted by the Department of Navy, the Department of Defense, and the Congress, to include coordination of Marine Corps appeals and responses to Program Budget Decisions and Congressional inquiries and decisions when manpower issues are involved. Responses to proposed program or budget cuts are called reclamas. Program Budget Decisions must be answered immediately to

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avoid loss of funding. They require the preparation of substantiating information concerning the effects of the proposed cuts. Data for reclamas must be gathered, prepared and staffed through the Headquarters in a matter of hours to meet the required deadlines. The reclama is ordinarily the last chance the Marine Corps has to document the need for manpower funding.

(7) Monitor Budget Execution. Monitor and review the execution of manpower programs and the MPMC budget. Actual by grade strengths and promotion plans are monitored on a monthly basis to ensure compliance with Marine Corps plans and legal end strength ceilings.* They also monitor the accession and release of officers and enlisted Marines to ensure that plans and quotas are met.

(8) Develop T2P2 Account Data. Prepare estimates and monitor actual experience for the P2T2 accounts. Information is gathered from several sources. The Training Department supplies school seat availability data an projections on the seat usage rate. Information on the characteristics of the transient population is developed from historical averages. The Recruit Training Model supplies data on the planned number and location of recruits who will be sent to schools from boot camp. In addition, summary data concerning Transient and Trainee statistics is available from automated reports. From summary data, weighted averaging is used to distribute the costs across grades. Subjective judgment is used to project the future amounts of the T2P2 account based on proposed changes in Manpower policies which would affect the Transient and Trainee populations.

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*These limits apply to aggregate and to geographical limits on manpower end-strength ceilings.

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d. Hierarchical Structure

Figure 3.2 shows the hierarchical relationships
of the functions of MPP-40 which have been identified. In
this view, the emphasis is on understanding which functions
are subordinate in a logical way to other functions. We
begin to see the initial structure of the functions on a
high level of abstraction. The designer can use this tool
and the data flow diagram to verify the view of the system
developed thus far with the user. The user can identify and
validate the description of the system from the narrative
and the graphical representations.

e. Equipment Available

Primarily, the section uses desk top calculators
as the primary aide for analysis. Occasionally, a
Hewlett-Packard minicomputer is used to produce the detailed
listing of the Five Year Defense Plan and some presentation
graphics. Two IBM Personal Computers are presently
available to the section. The personal computers are able
to access and download files from the Headquarters Master
File (HMF) at the Marine Corps Central Design and
Programming Activity (MCCDPA) in Quantico, VA.

f. Inputs

The programming and budgeting process for the
Manpower Department is a complex exercise involving many
different activities and sources of information. Many of
the flows of the data are not rigidly structured or easily
categorized in time phases, chronology or content. A list
of inputs is contained in Table 1. Because of the
time-phased nature of the POM process some outputs are also
used as inputs. For example, the near term years of the
Five Year Defense Plan (an output) are used as inputs for
budget preparation.
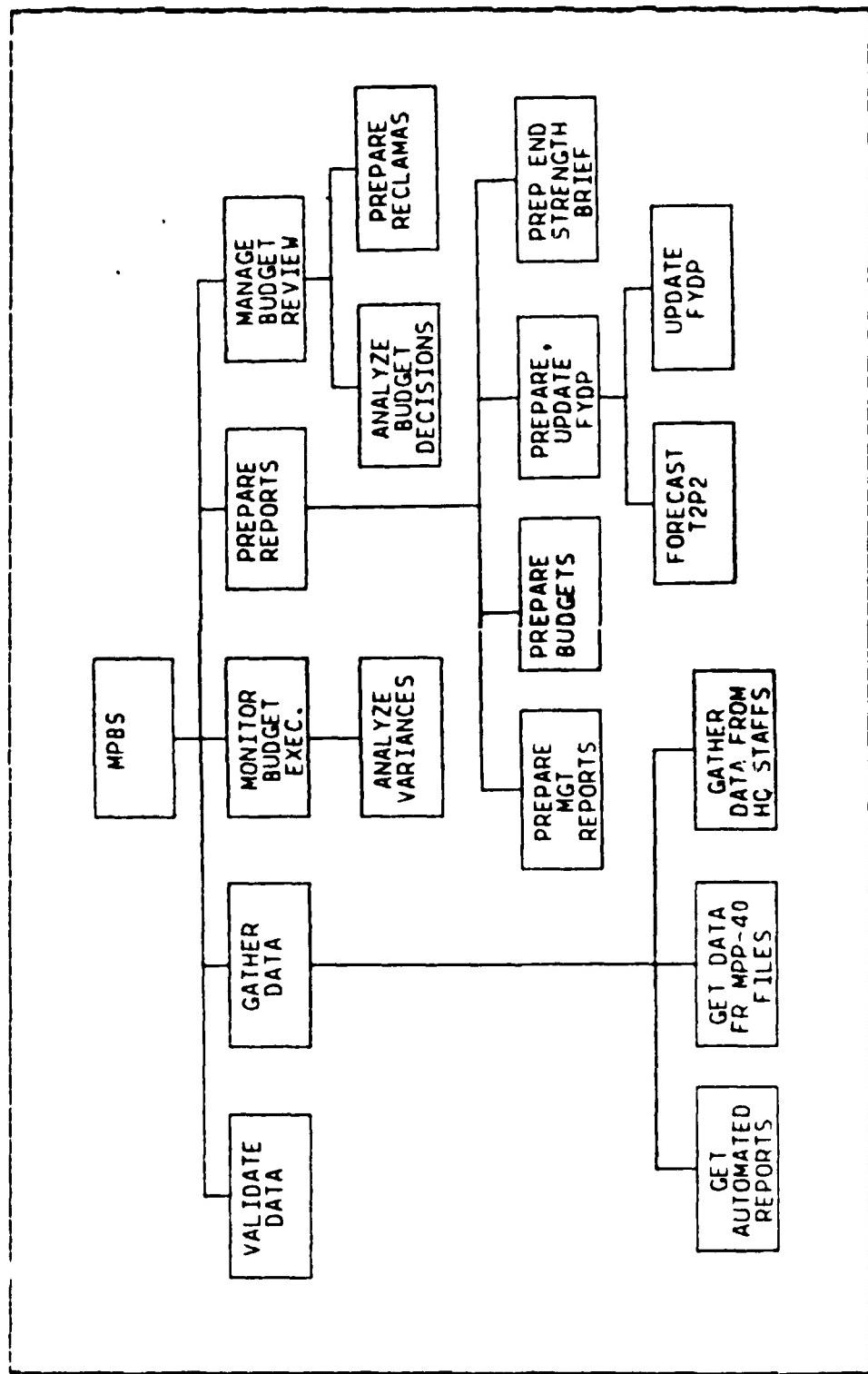
Figure 3.2   Functional Hierarchy of the Present System

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                        TABLE 1
        Inputs to the Programming and Budgeting Process

    SOURCE              DESCRIPTION

    JUMPS/MMS           Manpower Data about individuals

    TMR and
    Troop List          T/O, Manning, Structure data

    Transient
    Flow Model          Transient Line Projections

    NAVCOMPT,DoD        Programs targeted for reduction
                        by NAVCOMPT, DcD, OMB

    POM Process         Programs, initiatives which
                        have an impact on the MPMC and
                        O&MMC Appropriations

    FYDP                Near term years provide manyear base
                        from which budgets, POMs are prepared

    Manpower
    Plan                Used to set goals for USMC
                        manpower levels
```

(1) Table of Manpower Requirements(T/MR).   At
present MPP-40 receives periodic reports from the T/MR
system. These reports are in hard copy. They contain the
organizations within the Marine Corps, their Program Element
Numbers (a unique number which identifies a unit to a
specific defense program), geographic location codes, and
Table of Organization data. The reports are produced in a
variety of sorted listings by PEN numbers, combat units and
non-combat units, etc. The sections use the Table of
Manpower Requirements and Troop List to prepare the FYDP and
the Defense Manpower Requirements Report. It should be
noted that the T/MR and Troop List Systems are currently

being enhanced and re-designed to provide flexible on-line access to current changes in their databases.

(2) Troop List. This is maintained by the Requirements and Programs Division (R&P). It contains the levels at which the various Tables of Organization will be manned for the current year and the following five years. It is updated annually through the POM process.

(3) HMF and MMS. The units use various extractions from the Headquarters Master File (HMF) and the Manpower Management System (MMS) in preparation of statistics, reports, analyses and budgets. Extensive verification, transcription and preparation of the reports must be performed by budget analysts before they can be used. They must be cross-checked manually with other reports or validated based on the analysts' knowledge of the actual structure, organization, or reliability of the input. The data pertain to specific information connected with personnel transactions of all individual marines. All data concerning a marine is reported to MMS and is posted to an electronic personnel record.

(4) Historical Data. Because of the long range emphasis of the PPBS, data from prior and current year budgets, FYDPs and actual manpower statistics are used when when preparing current proposals and budgets. This historical data is stored in files in the MPP-40 workspaces as hardcopy reports and manual spreadsheets.

(5) Training Division. Information on school seat availability and the school outputs is used.

(6) Staff Judge Advocate. Information on education and numbers of lawyers on active duty are verified with this office.

g. Outputs

Nearly all the outputs of the present system are
manually prepared in hardcopy form. For the most part, the
information in the reports is manually verified by Structure
and Budget Analysts for accuracy and validity. See Table 2.
The reports discussed in the following paragraphs constitute
a major effort of the analysts on a monthly basis.

TABLE 2

Outputs of the Manpower Programming and Budgeting
System

Name	Frequency	Submitted to
FYDP	3 / year	Commandant, NAVCOMPT, DoD, OMB
Budgets	3 / year	NAVCOMPT, DoD, OMB, Congress
Budget Documentation	3 / year	NAVCOMPT, DoD, OMB, Congress
Management Reports	monthly	SecNav, SecDef, Congress
Congressional Witness Stmts	as req'd	Senior HQMC officials

(1) Five Year Defense Plan (FYDP). This a
planning document which contains all units in the Marine
Corps and their planned level of manning for the next five
years in units of manyears. It also contains overhead
accounts for manyear accounting for those marines who are
not chargeable to a unit, i.e., Patients, Prisoners,
Trainees and Transients.

The preparation and submission of the FYDP is coordinated and adjusted by the Programs section. It is prepared on an annual basis and is updated three times per year as a result of the budget submission process.

(2) Budgets. Manpower budgets are prepared for up to four budget years at a time: the present year and three years in the future. Budgets are submitted three times during the year. They are submitted to the Comptroller of the Navy (NAVCOMPT budget submission), Office of the Secretary of Defense (OSD budget submission) and Office of Management of Budget (OMB).

(3) Budget Documentation. Standard backup data must be prepared for all budget submissions justifying areas of special interest such as special pays, dependency information, enlistment and reenlistment bonuses and civilian and military clothing allowances.

(4) Management Reports. The section produces over ninety reports on a monthly, quarterly, semi-annual and annual basis. A discussion of the most significant reports in terms of mission importance, difficulty and preparation time is included here.

Officer Accessions and Attrition by Grade. This report is prepared monthly. The source of data is an extraction from the MMS data base. The report requires extensive manual audit and purification. It is estimated that the report requires, on average, three man days to prepare.

Monthly End Strength Report. Automated reports on Marine Corps end strength must be carefully cross-checked by various categories to ensure accuracy. This is due to the limit on annual end strengths set by Congress. The data are used for the monthly end strength brief given to the head of the Manpower Department and to the Assistant Commandant.

Location by Country Report. This monthly
report is sent to the OSD, NAVCOMPT and SECNAV. Due to
ceilings imposed by congress on the numbers of Marines
allowed in certain countries, this report must be carefully
prepared and cross-checked. Automated reports are verified
with reports from sponsors at Headquarters, and unit
deployment schedules about the location and latest
assignment of individual Marines and units. This report
requires approximately 1.5 weeks to prepare.

Civilian Education Report. This monthly
report requires an automated MMS extraction to be manually
updated based on input from functional sponsors at
Headquarters who have contradictory or more reliable data
than the report.

Turbulence Report. The analyst calculates
a cohort attrition factor on an monthly basis. The process
involves transcription of data to a spreadsheet and
calculation of attrition factors for cohorts. The process
takes approximately three days per month.

Dependency Reports. Data from MMS
extraction is applied to spreadsheets to determine by-grade
dependency information.

Longevity Reports. MMS extraction provides
data which is transferred to spreadsheets for consolidation
and analysis. Average length of service for all pay grades
is calculated.

Reports for the Commandant. Information of
personal interest to the Commandant is gathered on such
areas as end strengths, recruiting, accessions, Women
Marines, reenlistments, minorities and others as required.

Reenlistments and Retention Rates. This
information is calculated by budget analysts from file
extractions and used for budget estimation purposes. It is
done by occupational field and pay grade.

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Expiration of Active Service by Grades.
The automated reports which are received contain this data
in various forms. The reports are cross checked for
validity. This is an aging process that verifies the number
of enlisted marines whose contract will expire in the coming
six months.

Promotions by Grade. Reports from MMS
which detail the promotion of marines are cross checked
manually. A spreadsheet which details the gains and losses
at each grade due to promotions is updated. Transition
rates are calculated and totals are cross footed to ensure
that grades are in balance (generally, total promoted is a
total promotion gain for the next grade).This reports
requires approximately one week per month.

Gross Loss Data by Grade. Loss data from
other spreadsheets and reports is posted to this summary
spreadsheet. Values are cross totalled to ensure that all
losses are accounted for.

Non-EAS Attritions by Grade. Automated
reports are verified and posted to a spreadsheet which
details losses which are do to reasons other than the
expiration of the marines legal obligation to serve.

Women Marine Reenlistments. Reports
containing information about reenlistments by women marines
are posted to a spreadsheet. A report is sent to the
Department of Defense annually. The statistics are used
internally by the Marine Corps to monitor the women
population.

Other Reports. Most other reports which
MPP-40 produces are variants of those discussed above. They
are, generally, quarterly or semi-annual summaries of
monthly reports. Others are reports which contain
information already retrieved, calculated, or verified and
present it in different formats according.

3. Problem Description

There is an excessive amount of redundant manual
labor done by analysts and action officers to re-format and
validate data from automated files in a usable form. Manual
spreadsheets are used to reorganize data taken from computer
printouts. Data is not received in forms that are useful to
analysts.

There is no facility to quickly and easily sort,
compare and verify data that is received from automated
files. All these activities are done by organizing the data
on the spreadsheets. It is difficult and time-consuming to
put data in different forms.

The numerous statistical reports which must be
compiled require excessive manual transcription. Because
statistics are kept on manually prepared spreadsheets, there
is no convenient method to gather historical data for
inquiries or trend analysis. Monthly actual manpower
numbers must be gathered by a cumbersome manual process.

There is inadequate storage space for statistical
reports and all reports and working papers.

The method which must be used to gather actual
statistics about the T2P2 account is unreliable and time
consuming. There is no method to develop accurate estimates
for outyear T2P2 account amounts on a by grade, occupational
specialty basis.

This method is not suitable because it does not
allow the analyst to objectively consider the impact of
policy changes on the overhead account. In peace time, the
Patients and Prisoners remain stable and are easily and
reliably tracked through the automated personnel system.
However, the Transients and Trainees data is much more
difficult to measure. There are no methods at present to
capture the information to the level of detail needed. Data

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must be available down to the level where sources and destinations, durations and type of move, the specialty and grade of the member may be captured.

With this level of detail it will be possible to develop meaningful flow rates for various move categories. In addition, the impact of policy changes may be assessed. For example, the impact that a new school requirement for enlisted artillerymen of grades E-7 and above which would be located at Fort Sill, Oklahoma could be assessed. The cost in additional training man years, transient time manyears and permanent change of station funds could be predicted. At present, there is no way to to this.

Present methods of data extraction are not responsive to changing nature of user requirements. The present system of inflexible batch-oriented report production requires users to do excessive manual manipulation of data. Reports cannot be changed without a major effort. Analysts cannot charge formats, sort keys or specify new report extraction parameters without seeking assistance from outside to have the new report programmed.

The present batch-mode, manual labor intensive methods will not provide adequate service since two primary sources of data, T/MR and Troop List, are being enhanced to provide interactive processing. The manual preparation of data and reports will be counterproductive. The full potential benefits of these latter systems will not be gained.

C. REQUIRED CAPABILITIES

The new system should provide at a minimum:

1. A method to quickly, flexibly access MMS and HMF files and to edit and validate the information that they contain

2. A method to efficiently and reliably determine actual monthly manpower statistics.

3. The ability to produce required reports without redundant manual and automated processing.

4. Appropriate storage of historical data for ease of retrieval and physical security.

5. A method to easily explore the program and budgetary impact of management options in force structure or man years, i. e., what if capabilities.

6. A method to forecast the overhead accounts of Transients, Trainees, Patients and Prisoners.

7. A facility to interface to the NHPS/NHBS when it becomes operational.

1. Organizational Structure

The system will operate within the organizational structure of the Manpower Department. See Figure 2.2.

The users of the system will be the Program and Budget Units of the Plans, Programs and Budget Section, Manpower Programs, Plans and Policy Division, Manpower Department. See Figure 2.3.

2. Interface with Other Systems

There are several automated systems currently being developed which will provide inputs to the system or which will require outputs from the system. The following are Headquarters Marine Corps sponsored systems:

1. Officer Planning System (OPS)
2. Enlisted Planning System (EPS)
3. Automated Troop List
4. Table of Manpower Requirements (T/MR)
5. Transient Flow Model

These are batch process systems which provide hardcopy listings of Tables of Organization, unit strengths, and projected levels of personnel. They are being enhanced to provide on-line inquiry, update, and query processing capabilities. The final product will be a redesign of the systems to provide more reliable and flexible information.

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The Marine Corps has decided to participate in the
design and implementation of two Navy systems, Navy
Headquarters Programming System and Navy Headquarters
Budgeting System (NHPS/NHBS) [Ref. 7]. The systems are
early in the concept development phase. It is not possible
to define system interfaces at this point. There is a need
to address interface requirements to support Marine Corps
participation in these systems at the earliest possible
date.

It is not clear at this time to what extent Marine
Corps reporting requirements will be changed. The Navy
system is targeted to address mainly the automated reporting
of budget data to NAVCOMPT and not internal support of
collection, analysis, and preparation of data. The system
is scheduled for contract negotiation of detailed design and
implementation in late 1985. After this, precise interface
requirements will be available.

3. Operating Environment

The operating environment for the system is strictly
a garrison configuration. There is no requirement for
capability to deploy aboard ship or to any other location.
Either Marine Corps owned computers or a time sharing
service will be used to provide the processing support for
the system.

4. Communications Requirements

Detailed communications requirements cannot be
addressed at this point in project development. Possible
requirements could involve local area network configuration
and data link communication to a mainframe computer at a
remote site using telephone lines. There is no requirement
identified now for access to wide area networks such as the
Defense Data Network or the Marine Corps Data Network.

Existing commercial facilities for transmission and switching will be used.

Data to be exchanged would be file extractions from data bases such as MMS and HMP. It is likely that data exchanges would occur at least daily between mainframe and microcomputers, and between microcomputers.

5. Classification

There has been no requirement identified for secure data handling.

6. Performance Requirements

To be useful and acceptable the system must provide the ability to perform those manual processes which now require excessive amounts of time and effort. Report generation and data validation should be able to be accomplished in minutes instead of the delays of days now experienced for report preparation and manual validation.

The system must be accessible to the users and allow flexibility in decision option investigation. They should not have to leave the workspace to perform all facets of data handling, analysis and report generation.

The system should provide the capability to request ad hoc reports from MMS. An acceptable turn-around time would not exceed two hours.

Quality and accuracy of the P2T2 estimates should be measurable against actual experience to measure performance of the estimating process.

More quantitative performance criteria will be defined during subsequent phases of the system development process.

7. Requirements for Backup Capability

Due to the critical nature of the time sensitive programming and budgeting process there must be a provision for alternate processing in case of system failure. This backup capability will be provided through the manual processes presently used. Reliability of vendors and timely maintenance support should be a consideration in the selection process of equipment.

D. VALIDATION OF USER REQUIREMENTS

The manpower resource under any circumstance is a critical one. The Marine Corps is facing a harsh manpower environment for the rest of the decade as the available pool of eligible recruits begins to shrink. Manpower will become an even more scarce resource which will require the application of the most sophisticated tools at the disposal of the Corps.

Because of increasing pressure for federal fiscal restraint, the need for effective manpower management and planning tools becomes vital. Oversight by executive agencies and the Congress can only be expected to intensify in this atmosphere. This will require advanced management tools to keep pace with increasing reporting and analysis requirements.

The present system provides minimum level of utility at a great effort level. It will not meet the more sophisticated data management, reporting, and analysis requirements that will be encountered in an environment of dwindling manpower resources and tightening fiscal controls. An enhanced system with the capabilities described in this requirements statement will be necessary to meet the challenge. In order for the Marine Corps to effectively manage its manpower assets, compete in the manpower resource

market and the increasingly restrictive budget arena, it
must have at its disposal every means with which to justify
and defend programs and acquire resources to carry out its
mission.

IV. FEASIBILITY STUDY

A. GENERAL

The purposes of the feasibility study are to identify alternative approaches to satisfy the user needs set forth in the Requirements Statement and identify approaches which are operationally and technically feasible.

This feasibility study presents the results of the analysis of alternative approaches to satisfy user requirements which were set forth in the Requirements Statement for the Manpower Programming and Budgeting System (MPBS).

Figure 4.1 below shows the alternative approaches which have been evaluated as possible solutions to the problems outlined in the MENS.

```
Alternative 1 =>   Distributed Processing.
                   Automated system using a combination
                   of mainframe and personal computers.

Alternative 2 =>   Centralized Processing.
                   Automated system using a mainframe.

Alternative 3 =>   Distributed Processing with Network.
                   Same as Alternative 1, with personal
                   computers networked.

Alternative 4 =>   Existing System.
                   Manual-oriented processing system.
```

Figure 4.1   Alternatives to be Evaluated

This feasibility study includes the following information:

1. A description of the alternatives recommended for further analysis.

2. A description of the existing system.

3. Discussion of the be fits f the technically and
   operationally feasib   alt rnatives.

4. Discuss. n of the basis for selecting the preferred
   alternatives.

1. Problem and User Requirements

    See the Mission Element Need Statement (MENS) and
Requirements Statement for the MPBS for discussion of the
problem and user requirements.

2. AIS Guidelines and Constraints

    During the development of the MPBS, the design must
reflect the projected requirements of systems being
developed by the Department of the Navy. The Navy
Headquarters Programming System (NHPS) and Navy Headquarters
Budgeting System (NHBS) are currently early in the concept
development stage. It is not known when specific interface
specifications will be available. Design of the MPBS should
attempt to reduce duplication of effort and hardware
required in the proposed Navy systems. MPBS should
incorporate flexible design to allow for future changes in
Navy reporting requirements. It must also also satisfy
internal Marine Corps manpower planning and budgeting
requirements.

3. System Title

    On approval of the Feasibility Study the title of
the system will be the Manpower Planning Programming and
Budgeting System (MPBS) [Ref. 5: p. 1].

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B. FEASIBLE ALTERNATIVES

It is recommended that the alternatives described in this section be developed conceptually and analyzed as approaches to satisfy the user requirements specified in the MENS MPBS. These alternatives were selected from among four. The alternative that was not selected is discussed functionally under Other Alternative in this chapter.

The feasible alternatives are listed in Figure 4.2.

```
Alternative 1 =>   Distributed Processing.
                   Automated system using a combination
                   of mainframe and personal computers.

Alternative 2 =>   Centralized Processing.
                   Automated system using a mainframe.

Alternative 3 =>   Distributed Processing with Network.
                   Same as Alternative 1, with personal
                   computers networked.
```

Figure 4.2   Feasible Alternatives

1. Description of Alternative 1

This is a combination of microcomputer and mainframe processors. Each type of machine is tasked with performing jobs to which it is best suited. This allows flexibility and efficient use of resources. Figure 4.3 shows a simplified view of how such a system would be configured.

The inputs for this alternative are shown in Figure 1 and are discussed in Chapter II.

The outputs for this alternative are shown in Figure 2. They are discussed in Chapter II.

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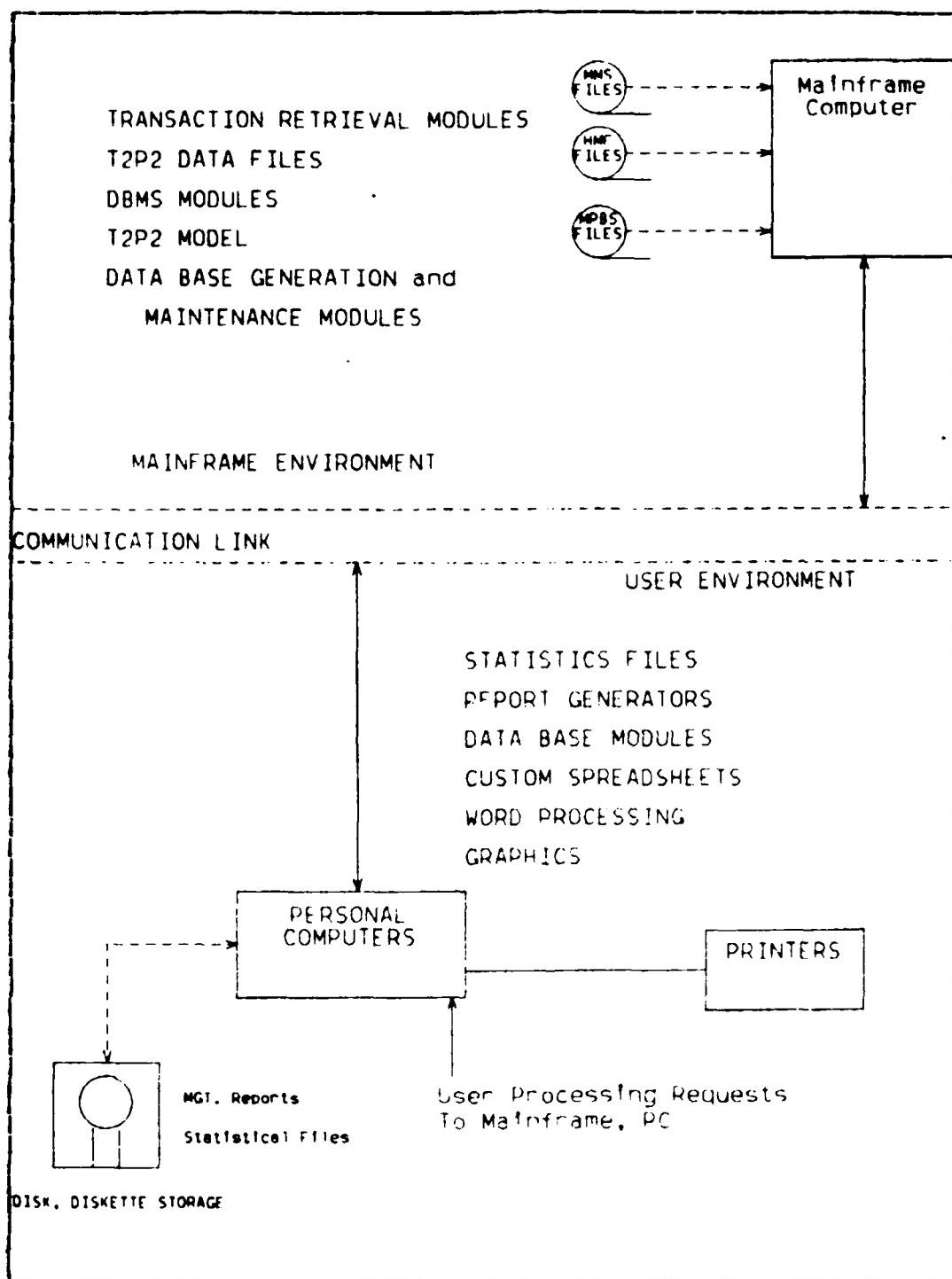
Figure 4.3   System Configuration for Alterna_ive 1:
                Distributed Processing.

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a.   Software

       For the microcomputer based portions,
authorization will be requested to use widely accepted
integrated software systems functionally equivalent to Lotus
Corporation's Symphony, Ashton-Tate's dBase series of
software, and a widely used microcomputer based language
such as BASIC or Pascal. Word processing would be
accomplished through either an integrated software package
or a separate commercial word processing program. Software
for mainframe applications will be a written in a Department
of Defense approved high level language. Software support
for this alternative consists of the following general
requirements.

1.   Interactive data entry sessions to accept user
     requests for data storage, retrieval and
     manipulation.

2.   Interactive input sessions to accept user input of
     parameters for jobs which will be required to be run
     on a mainframe.

3.   A mathematic projection model to forecast transients,
     trainees, patients and prisoners (T2P2) rates and
     dollar costs based on user supplied assumptions.

4.   File maintenance and interface programs to build
     required mainframe and microcomputer files which will
     be used by the modelling program, data base
     management programs, and automated spreadsheet
     programs.

5.   Transaction retrieval software to gather data
     concerning the characteristics of Marines in a
     transient, trainee, patient or prisoner status.

6.   Computation and automated spreadsheet programs to
     prepare management reports, budget submissions, Five
     Year Defense Plans, etc.

7.   Report formatting programs to produce required
     reports (budgets, POMs, FYDPs, and ad hoc reports).

8.   Graphics software to allow users to prepare regular
     and special graphical analyses with little special
     training.

9.   Word processing software to reduce repetitive
     drafting and retyping of reports and correspondence.

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b. Equipment

Four microcomputers with the following characteristics will be required for this alternative:
1. 512K byte Random Access Memory (RAM)
2. 10 Megabyte internal hard disk drive
3. 360K byte floppy disk drive
4. Monochrome monitor
5. Graphics capability
6. Dot matrix printer
7. Bisynchronous Communications Adapter

There are two options for mainframe processors which could be used by the system. The first is the mainframe processor at the Central Design and Programming Activity, Quantico, Virginia. It is an AMDAHL V/7 series 4 which operates under the TSO (Time Sharing Option) operating system. The second is the Control Data Corporation (CDC) Cybernet System located in Rockville, Maryland, which operates under Network Operating System (NOS).

Leased communications lines to CDPA, Quantico, VA. or CDC, Rockville, Maryland, as applicable will be required to support communications from the personal computers to the mainframe.

2. Description of Alternative 2

This alternative uses a single mainframe processor. The AMDAHL 470 V/7 at the MCCDPA, Quantico, VA or the CDC Cybernet System in Rockville, Maryland are the likely hosts. All significant processing will be performed on the mainframe computer. Users will access the system through direct connected video terminals located in their workspaces. Processing will be a combination of batch and interactive modes. File processing and mathematical forecasting will be done in batch for increased efficiency.

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User interfaces will be in interactive mode for requesting reports and processing. Figure 4.4 is a high level view of the basic system configuration.

a.   Inputs and Outputs

The inputs and outputs for this alternative are found in Table 1 and Table 2 and are discussed in Chapter II.

b.   Software

Word processing would be accomplished through the present stand alone system. Scftware for mainframe applications will be a written in a Department of Defense approved high level language. Software support for this alternative consists of the following general requirements.

1. Interactive data entry sessions to accept user requests for data storage, retrieval and manipulation.

2. Interactive input sessions to accept user input of parameters for jobs which tc be run on the mainframe.

3. A mathematic projection model to forecast transients, trainees, patients and priscners (T2P2) rates and dollar costs based on user supplied assumptions.

4. File maintenance and interface programs to build required files which will be used by the modelling program and data base management programs.

5. Transaction retrieval software to gather data concerning the characteristics of Marines in a transient, trainee, patient or prisoner status.

6. Report formatting programs to produce required reports (budgets, POMs, FYDPs, and ad hoc reports).

c.   Equipment

As in the first alternative there are two options fcr mainframe processors which could be used by the system. AMDAHL V/7 series 4. at the CDPA, Quantico or the CDC Cybernet System located in Rockville, Maryland.

Leased communications lines to CDPA, Quantico, VA. or CDC, Rockville, Maryland, as required.

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Transaction Retrieval Modules

T2P2 Data Files

DBMS Modules

T2P2 Model

Control Modules

Data Base Generation, Maintenance Modules

Mgt. Reports

Statistics Files

Report Generators

MAINFRAME ENVIRONMENT

COMMUNICATION LINK

USER ENVIRONMENT

User Processing Requests
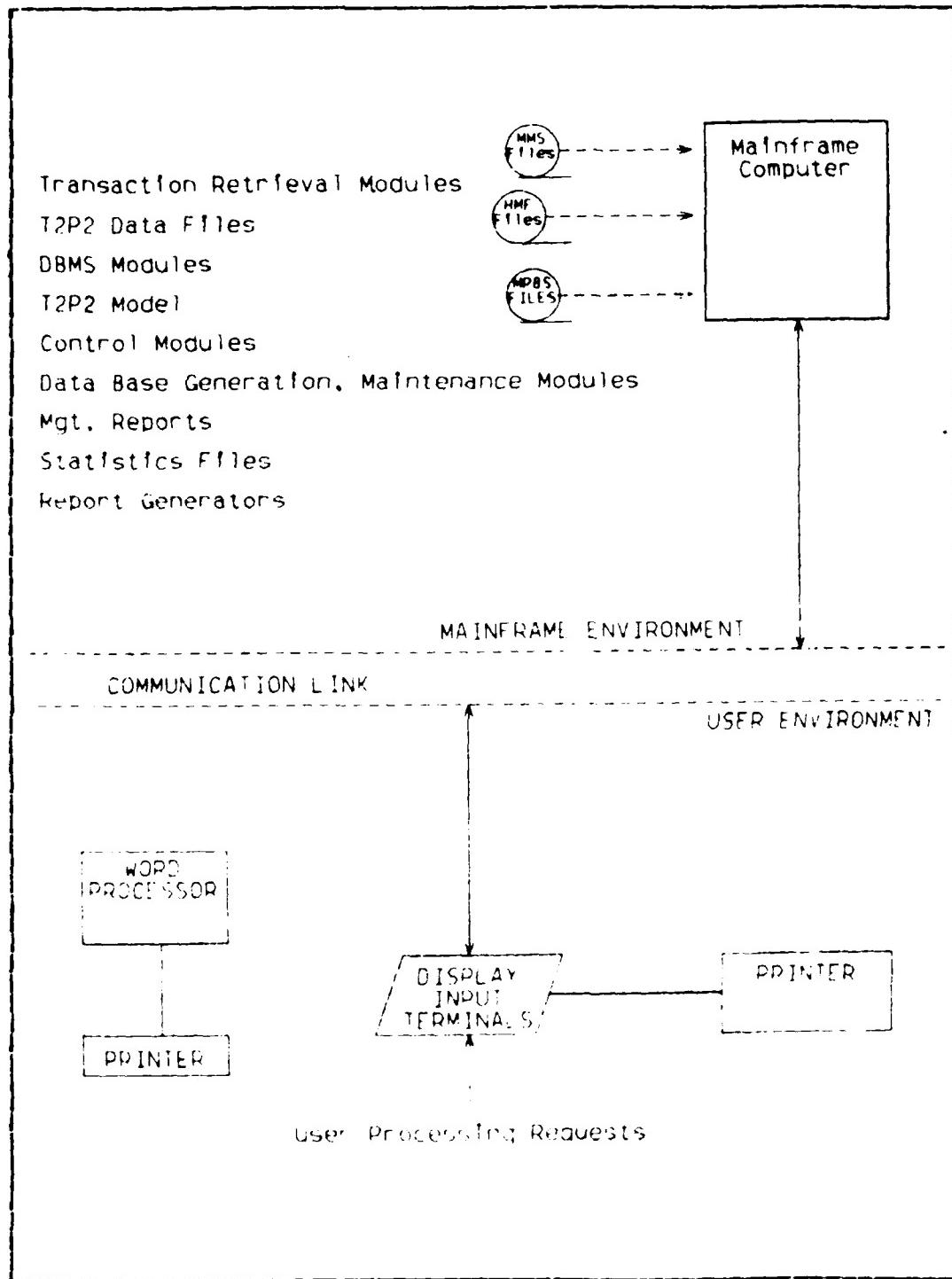
Figure 4.4   System Configuration for Alternative 2 :
              Centralized Processing.

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Three terminal display units of the IBM 32XX
series would be required for user interaction.

3. Description of Alternative 3

This alternative is similar to Alternative 1, with
the added capability of a local area network. This feature
will allow implementation of an office automation
environment within MPP-40. This will allow user to share
resources such as printers and fixed disk drives. In
addition, this will allow analysts to share data and
reports, and access common files cn one another's system
and on the system's shared disk drive. See Figure 4.5 for a
diagram of this configuration. The use of networking
technology will enhance the the efficiency and flexibility
of administrative functions and allow information to be more
easily shared among users.

a. Inputs and outputs

The inputs for this alternative are shown in
Table 1 and are discussed in Chapter II.

b. Software

Besides the software required under Alternative
1, commercial network software will be purchased to
implement high level network functions such as message
handling, error control, network management and network
server control.

c. Equipment

Besides to the equipment required in Alternative
1, a network translator, network adapter cards, hook up kits
and cables will be required to support the network
functions. refblk 15 contains an useful discussion of the
hardware and software required for the IBM network.

TRANSACTION RETRIEVAL MODULES

T2P2 DATA FILES

DBMS MODULES

T2P2 MODEL

DATABASE GENERATION and
    MAINTENANCE MODULES

MAINFRAME ENVIRONMENT

MAINFRAME
COMPUTER

MMS FILES

HMF FILES

MPBS FILES

COMMUNICATION LINK

USER ENVIRONMENT : LOCAL AREA NETWORK
                STATISTICS FILES
                REPORT GENERATORS
                DATA BASE MODULES
                CUSTOM SPREADSHEETS
                WORDPROCESSING
                GRAPHICS
                NETWORK SOFTWARE

PERSONAL COMPUTER 1

PERSONAL COMPUTER 2

PERSONAL COMPUTER 3

PERSONAL COMPUTER n

MANAGEMENT REPORTS

STATISTICS FILES

DISKETTE STORAGE

SHARED FIXED DISK

NETWORK SERVER

SHARED PRINTER

Figure 4.5   System Configuration for Alternative 3:
    Distributed Processing With local Area Network.

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C. OTHER ALTERNATIVES

This section describes the alternatives to satisfy the user requirements specified in the Requirements Statement that were analyzed but not recommended for further development and analysis.

1. Existing System

The following is a high level overview of the functions of the present methods which MPP-40 uses to carry out its mission. Figure 4.6 is a simplified model of existing processing steps.

a. Concept.

Presently most data retrieval and information processing is done manually. Data is transcribed from computer generated listings onto large spreadsheets. From these spreadsheets, analysts organize data, prepare reports and perform analyses. Information for Programming and Budgeting purposes is gathered in this way. This involves much labor intensive reprocessing of automated output because it is not in required formats.

Rates for the Transients and Trainees lines of the Manpower budget are calculated using simple averaging techniques. There is no method for analysts to perform the desired sophisticated studies of future rates.

Manual spreadsheets are stored in file cabinets in cramped workspaces. Because of their size and the number of spreadsheets which must be kept, it is difficult to do statistical or trend analysis on the data. The information kept must be retained indefinitely for future budget analysis. However, the longer it is kept, the more difficult it becomes to extract meaningful information, due to inconsistencies over time in the way the numbers were gathered and calculated and the sheer volume of the data.

Analysts and budget officers must prepare many reports and analyses on a regular basis. They also prepare special reports and studies on request. At present, these are written out longhand, often using transcribed data from the office files. The administrative assistant retypes the information prepared by the analysts in the format required for the occasion, e.g., ad hoc request, routine assorted management reports, budget reclamas, etc.

b. Inputs and Outputs

See Tables 1 and 2 for a summary description of the inputs and outputs of the system.

c. Software

The software used in the present system consists of batch oriented data extraction and report formatting applications used to produce the reports from which the analysts begin their manual processing. Word processing software currently is used on a dedicated wordprocessor by the administrative assistant.

d. Equipment

At present the AMDAHL V/7 series 4 is used to produce the management reports. Word processing is done on a dedicated word processing unit. Graphics are done on a Hewlett-Packard minicomputer shared within the MPP branch.

D. FEASIBILITY DETERMINATION

The purpose of this section is to present the results of analyzing each alternative described above to determine whether it is feasible. The alternatives will be analyzed for operational and technical feasibility.
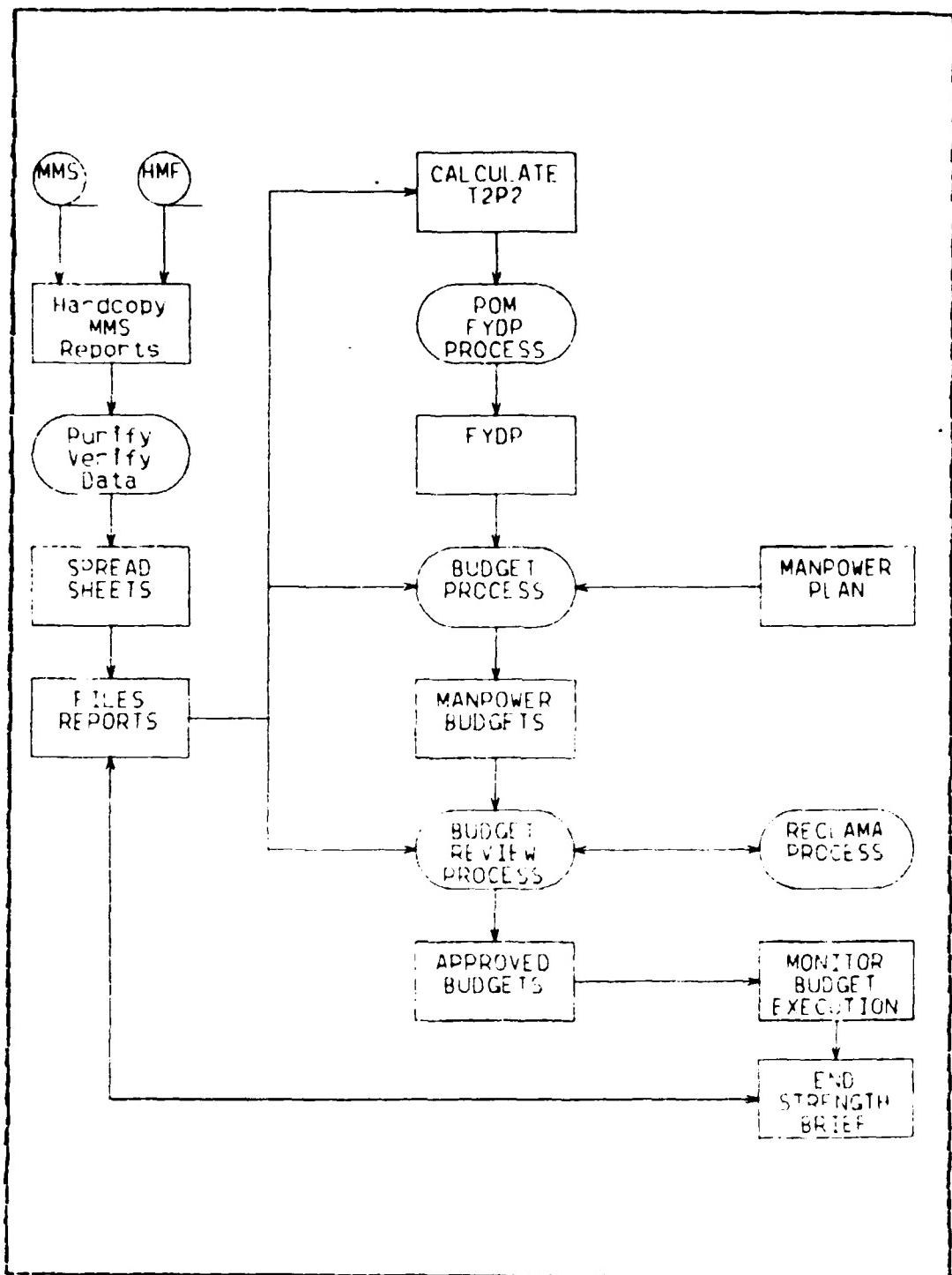
Figure 4.6   System Configuration for Alternative 4:
                      Existing System.

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The Marine Corps uses the following definition of feasibility:

"...feasible suggests what is likely to work or be useful in achieving satisfaction of user requirements." [Ref. 2: p. E-4]

The following is the general criteria which the Marine Corps uses as guidelines when evaluating feasibility:

"...all aspects of the system should be state-of-the-practice. This includes equipment, software, communications and the means that are used to employ them. The Marine Corps should not be in the information system research and development business. It should not serve as a test bed for unproven technology." [Ref. 2: E-4]

1. Aspects of Technical Feasibility

a. Hardware.

The following are operational and design traits which the hardware must possess to be considered feasible:

1. The hardware used should have sufficient memory capacity and speed to perform the calculations required by the the T2P2 projection model.

2. Hardware must have sufficient input and output capacity in order to handle the required data from existing systems.

3. The hardware should have enough capacity to satisfy throughput requirements. It should be able to produce reports within required time constraints.

4. The hardware must be flexible enough to allow future expansion of processing capacity and peripherals.

5. The hardware must be compatible with existing hardware so that as a minimum, files may be transferred.

6. The hardware must be state-cf-the-practice. It must be a full scale production model, with a record of wide use and acceptance.

b. Software

In order for applications software to be considered feasible they must meet the following criteria:

1. Provide sufficient capabilities to support the required algorithms for construction of complex mathematical models to perform the T2P2 projections.

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2. Provide a high level user interface which will allow for a minimum of specialized user knowledge and training.

3. Allow a flexible and simple method to produce regular and special reports.

4. Support the data base and file structure access requirements in existing Marine Corps systems.

5. Allow use of modern structured software design and maintenance techniques.

6. Allow the user to aggregate and view the data in various ways, through data manipulation commands.

7. Provide an acceptable level of accuracy for required computations.

8. Provide for efficient word processing capability.

    c. Telecommunications

        The proposed system must meet the following requirements:

1. Proposed communications methods for an alternative must use existing communication systems.

2. Telecommunications technology must be reliable and state-of-the-practice.

3. Telecommunications portions of the system must be able to support system perfcrmance requirements. [Ref. 2: p. E-4]

    d. System Integration

        The proposed system must be able to integrate elements of hardware, software and telecommunications in a low-risk, state-of-the-practice method [Ref. 2: p. E-4].

2. General Operational Feasibility Requirement

        This aspect of feasibility involves satisfaction of the user requirements as defined in the MPBS Requirements Statement. They are derived from the criterion that the system must not adversely affect the accomplishment of any mission of the Marine Corps or any of its subdivisions [Ref. 2: p. E-4].

The integration of the system into the local information processing environment must be considered. In addition to satisfying the functional requirements, the alternatives' impacts on the user organization itself must be considered. The following are operational feasibility criteria which will govern the alternatives' evaluation:

1. The alternative must satisfy all functions in the Requirements Statement.

2. The alternative must not adversely affect the present organizational structure of the Manpower Department.

3. The alternative must not require excessive office space.

4. The alternative must not require additional manpower to use or maintain.

B. ANALYSIS OF ALTERNATIVES

The feasible alternatives are:

```
Alternative 1:   Distributed Processing

Alternative 2:   Centralized Processing

Alternative 3:   Distributed Processing with Network
```

Each of the alternatives has been evaluated based on the operational and technical feasibility issues above. If an alternative failed any single issue it was considered infeasible and dropped from further consideration [Ref. 2: E-4]. The results of the feasibility determination are summarized in Table 3.

1. Alternative 1: Distributed Processing

This alternative meets all technical and operational feasibility issues. The hardware and software proposed for this alternative are similar to those used in other Marine Corps manpower modeling systems. They are presently

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satisfying related functional requirements. The personal
computer portion of the alternative involves the use of the
widely used personal computer with internal hard-disk and
video display terminal. This technology is also widely used
throughout the Marine Corps. The integration of these
approaches uses a technology which is reasonably mature and
common in many office and business data processing
operations. The communications systems proposed make use of
presently available commercial leased lines. No adverse
impact of an organizational nature will occur with this
alternative.

2. **Alternative 2: Centralized Processing**

This alternative meets all technical and operational
feasibility issues. The mainframe and communications
portions of the proposed method are the same as in
Alternative 1. They are presently being used in existing
Marine Corps automated manpower systems. This alternative
is a variation of Alternative 1. All processing would take
place on a mainframe computer. The present word processing
equipment would continue to be used.

3. **Alternative 3: Distributed Processing with Network**

The discussion for this alternative is similar to
Alternative 1. Local area network capability meets all
operational and technical feasibility criteria.

4. **Alternative 4: Existing System**

This was determined to be infeasible. The present
system does not satisfy the user requirements as outlined in
the Requirements Statement for MPBS.

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TABLE 3

Summary of Feasibility Analysis

Feasibility Issue	Distributed	Centralized	Distributed Network	Existing
HARDWARE				
Memory capacity for math model	YES	YES	YES	NA
Processing Speed for math model	YES	YES	YES	NA
Input/Output Capacity	YES	YES	YES	NA
Overall Throughput	YES	YES	YES	NA
Expansion Capacity	YES	YES	YES	NA
Ability to retrieve transactions	YES	YES	YES	NO
Reliability	YES	YES	YES	YES
SOFTWARE				
Support Math Model algorithms	YES	YES	YES	NA
High Level User Interface	YES	YES	YES	NO
Flexible Report generation	YES	YES	YES	NO
Interface with existing software	YES	YES	YES	NA
Allow Structured design maintenance	YES	YES	YES	NA
Adequate Application Software for data handling	YES	YES	YES	NA
Accuracy	YES	YES	YES	NO
Word processing	YES	YES	YES	YES

Table 3

Summary of Feasibility Analysis (cont'd.)

Feasibility Issue	Distributed	Centralized	Distributed Network	Existing
COMMUNICATIONS				
Use existing systems	YES	YES	YES	NA
State-of-the-practice methods	YES	YES	YES	YES
Meet system performance requirements	YES	YES	YES	NO
System Integration-Standard configuration methods	YES	YES	YES	YES
OPERATIONAL CRITERIA				
Manning	YES	YES	YES	YES
Organizational Structure	YES	YES	YES	YES
Meets all Functional Requirements	YES	YES	YES	NO
Meets space constraints	YES	YES	YES	YES
Additional manpower not required	YES	YES	YES	YES

V. ECONOMIC ANALYSIS

A. INTRODUCTION

This is an economic analysis of the feasible
alternatives for the MPBS. Only those alternatives which
were recommended in the Feasibility Study will be analyzed
in detail. The status quo is not included as it is not
considered to be a feasible alternative.

1. Methodology

The analysis of alternatives was conducted using
generally accepted economic analysis techniques. [Ref. 8]
provides a basis for the general structure of the study.

The software costing portion of the study was done
using the Intermediate Constructive Cost Model (COCOMO)
developed by Barry W. Boehm. This model estimates the
costs, level of development effort and schedule for software
projects. It is based on estimates of program size
(measured in number of delivered source instructions) and
attributes (machine characteristics, type of application,
and personnel attributes, to name a few). Estimates of size
are based on a high level decomposition of the software
product into functional processing subsystems. These
subsystems are then sized and rated according to their more
narrowly defined functions.

Expected benefits of the system were quantified by
weighting them in relative importance. Cost to benefit
ratios were calculated for alternatives based on estimates
of system costs and anticipated benefits.

A sensitivity analysis was done to ascertain the
susceptibility of results to changes in assumptions or the
environment.

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B. OBJECTIVE

The objectives of the Manpower Programming and Planning System are outlined in the MPBS Requirements Statement. The Requirements Statement contains the functional requirements which must be satisfied by candidate solutions.

The objective of this analysis is to study the feasible alternatives and to determine the most economically justified. This is based on a quantification of costs and benefits associated with a given alternative.

C. ASSUMPTIONS

The following are assumptions and constraints used as the basis for this analysis.

A five year economic life will be used. The discount rate is ten per cent with no differential inflation rate applied [Ref. 8: p. 9-2].

Permission will be obtained to use a language such as BASIC or Pascal for the microcomputer based portions of Alternatives 1 and 3.

Commercially available software for database applications such as Ashton Tate's dBASE III or spreadsheet programs such as Lotus Corporation's Symphony will be used to program a large portion of microcomputer applications.

Contractor support will be used for the detailed design and implementation of the system.

No assumption is made for the source of maintenance labor (i. e., in-house or contractor). For purposes of comparison only, maintenance costs are estimated based on rates for civilian contractors. The source of the maintenance effort would ordinarily be based on the availability, reliability, and level of expertise of in-house versus contractor personnel. We assume that the most cost effective, efficient decision concerning the

source of maintenance labor will be made during the Definition and Design phase. At that time the level of complexity of the project and availability of resources will become more apparent.

Hardware costs are from the latest available General Services Administration (GSA) Schedules [Ref. 10]. Purchased software (off the shelf) applications costs are from the same source.

Mainframe charges are based on commercially available time sharing costs. We recognize that the Central Design and Programming Activity (CDPA), Quantico, Virginia or Control Data Corporation (CDC), Rockville, Maryland may be the actual host site. The analysis will apply an opportunity cost based on commercial charges as if the system were implemented in Quantico.

Direct manpower costs under all alternatives are equal. While we expect there to be an increase in productivity, there are no expected labor savings in manpower costs to the user. Staffing levels under all alternatives will remain at the present levels.

Labor rates used for software estimates vary from $40 to $50 per hour, depending the degre of expertise required [Ref. 11: p. 29], with 152 hours qual to one man month [Ref. 12: p. 59].

1. Sunk Costs

The following items have already been bought or are available to the users. Since they would be available under any alternative, their cost will not be considered in the analysis [Ref. 8: p. 2-5].

Two IBM PC/XT personal computers and one dot matrix printer have already been purchased. They are being used for user written "throw away" programs and report generation. Database and spreadsheet applications were also purchased.

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MPP-40 occasionally uses a Hewlett-Packard
minicomputer, located in an adjacent office to do reports
and graphics generation. This cost will not be considered.

MPP-40 presently has a stand alone wordprocessor,
which is used mainly by the administrative assistant. Its
cost will be not be considered in the analysis.

The investment costs associated with the computer
operations center at the CDPA, Quartico will not be
considered.

D. ALTERNATIVES

The alternatives to be evaluated are:

Alternative 1:	Distributed Processing
Alternative 2:	Centralized Processing
Alternative 3:	Distributed Network

A description of the characteristics and capabilities of
the alternatives to be evaluated is contained in the
Feasibility Study portion of this study.

E. COST ANALYSIS

1. Background

Costs for this analysis are divided into recurring
and non-recurring categories [Ref. 8: p. 2-3]. Some costs
of the system to be implemented will not be included in the
analysis. These are the sunk costs of existing hardware and
software and other capabilities which have already been
purchased for MPP-40 or are already available. These items
were discussed above under Sunk Costs.

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Concerning the number of personal computers, we will use the number which must be purchased besides the two already installed. To arrive at the actual number available to users for a given alternative, the two computers presently owned must be added to the numbers we use.

Undiscounted life cycle costs for each alternative are summarized in Tables 4 through 6.

Detailed breakdowns for each alternative by category of expense are contained in subsequent tables. Discussion of costs for each alternative follows.

2. <u>Non-recurring Costs</u>

Non-recurring costs are those costs which may be expected to be incurred only one time, usually at the initiation of the system development life cycle.

a. Equipment Purchases

Depending on the alternative, up to four complete workstation configurations will be required. In addition, at least one draft quality printer (dot matrix), a printer with graphics capability and a letter quality printer will be required. Each workstation will require communications and serial input-output capability.

(1) <u>Alternative 1</u>. This alternative uses a combination of personal computers and a mainframe computer. Investment costs for this alternative are for the microcomputers only. No new mainframe equipment will need to be purchased. Either the Marine Corps owned computer at the CDPA, Quantico or a time sharing service (CDC) will be used.

TABLE 4

Undiscounted Costs: Alternative 1

COST ELEMENT	FY 86	FY87	FY88	FY89	FY90	FY91	COST
Nonrecurring Costs							
Hardware	$ 19,582						$ 19,582
Software	5,820						5,820
Software Development	218,000						218,000
Mainframe Dev. Chgs.	15,990						15,990
Recurring Costs							
Software Maint.	0	23,500	23,500	23,500	23,500	23,500	117,500
Mainframe Chgs.	0	10,908	10,908	10,908	10,908	10,908	54,540
Total	$ 259,392	34,408	34,408	34,408	34,408	34,408	$ 431,432

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TABLE 5

Undiscounted Costs: Alternative 2

COST ELEMENT	FY 86	FY87	FY88	FY89	FY90	FY91	COST
Nonrecurring Costs							
Hardware	$ 7,350						$ 7,350
Software	0						0
Software development	188,000						188,000
Mainframe dev. chgs.	21,077						21,077
Recurring Costs							
Software Maint		18,000	18,000	18,000	18,000	18,000	90,000
Mainframe Charges		17,448	17,448	17,448	17,448	17,448	87,240
Total	$ 216,427	35,448	35,448	35,448	35,448	35,444	$ 393,667

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TABLE 6

Undiscounted Costs: Alternative 3

COST ELEMENT	FY 86	FY87	FY88	FY89	FY90	FY91	TOTAL COST
Nonrecurring Costs							
Hardware	$ 23,477						$ 23,477
Software	6,500						6,500
Software development	218,000						218,000
Mainframe dev. chgs	15,990						15,990
Recurring Costs							
Software Maint.	0	23,500	23,500	23,500	23,500	23,500	117,500
Mainframe Charges	0	10,908	10,908	10,908	10,908	10,908	54,540
Total	$ 263,967	34,408	34,408	34,408	34,408	34,408	436,007

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A total of four additional personal computers will be required. Equipment costs are detailed in Table 7.

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----------------------------------------------------------------

                          TABLE 7
         Hardware and Software Costs for Alternative 1

                        COST    QUANTITY    TOTAL COST
    Hardware

    IBM PC XT       $ 2,992        4        $ 11,968
    IBM PC            1,800        0               0
    Expansion Option    185        4             740
    64Kb Memory          70       16           1,120
    Monitor             192        4             768
    Graphics Adapter    175        4             700
    32XX Emulator       490        3           1,470
    Printer Adapter     171        4             684
    Cables, misc        150        4             600
    Graphics Printer    332        1             332
    Matrix Printer      300        4           1,200
                                             --------
       Total Equipment Cost                  $ 19,582

    Software

    Spreadsheet      $  450        4        $   1,800
    Database            490        4            1,960
    Wordprocessing      350        4            1,400
    DOS 2.1              40        4              160
    Compilers           200        1              200
    Programming Aides    50        6              300
                                             --------
       Total Software Cost                   $  5,820
                                             --------
    Total System Cost                        $ 25,402
                                             ========
```

(2) **Alternative 2.** This alternative will not require purchase of processors. However, terminal devices will need to be used for data entry and system operation. Also, a printer will be required. See Table 8 for a summary of equipment costs.

(3) **Alternative 3.** This alternative is similar to alternative 1. Here, however, the personal computers will be networked to provide an office automation

TABLE 8

Hardware and Software Costs for Alternative 2

Hardware	COST	QUANTITY	TOTAL COST
IBM 32XX Terminal	2,000	3	6,000
Installation charges	250	3	750
Total Hardware Cost			$ 7,350

environment. The same number of personal computers will be required as in Alternative 1. However, they will not all need to be IBM/XT or the equivalent. This is because the network will allow sharing of a fixed disk and printer by several users. In addition, network hardware will be required for all personal computers. See Table 9 for a summary of hardware and software costs associated with this alternative. IBM retail prices for network hardware and software were used [Ref. 15: pp. 1-6]. GSA prices were not available.

    b. Software purchases

Besides the required operating system software for each new workstation, other software will be needed for development of applications. Under this category, only that software actually purchased outright is included. Custom software development and programming costs are discussed below under Software Development Cost Estimates.

    (1) Alternative 1. Electronic spreadsheet, database software, language compilers and software development tools and wordprocessing software will be purchased. These will be used only for the microcomputer

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TABLE 9

Hardware and Software Costs for Alternative 3

Hardware	PRICE	QUANTITY	TOTAL COST
IBM PC XT	$ 2,992	2	$ 5,984
IBM PC	1,800	2	3,600
50Mb Disk	1,000	1	1,000
64K memory	70	22	1,540
Monitor	192	4	768
Expansion Option	185	4	740
BSync Adapter	168	3	504
Graphics Adapter	175	4	700
32XX Emulator	490	3	1,470
Printer Adapter	171	4	684
Cables misc	250	4	1,000
Graphics Printer	314	1	314
Network Hardware			
PC Net Adapter	695	6	4,170
Net Translator	595	1	595
Cable Kit	39	6	234
Cable, 25 ft. ea.	29	6	174
Total Hardware Cost			$ 23,477
Software			
Network Software	$ 75	6	$ 450
Spreadsheet	450	4	1,800
Database	490	4	1,960
Wordprocessing	350	4	1,400
Compilers	200	1	200
DOS 3.1	65	6	390
Programming Aides	50	6	300
Total Software Cost			$ 6,500
Total System Cost			$ 29,977

portion of the system. All mainframe software will already
be available. See Table 7 for a cost break down.

     (2) _Alternative 2_. No software products will
need to be purchased if the system is implemented on a
mainframe computer. All software required (except custom
software) will be readily available.

(3) <u>Alternative 3</u>.   Software will be
essentially the same as in Alternative 1.   Network software
will be needed to support data and message communications
and device sharing for fixed disks and printers.   Costs are
detailed in Table 9.

c.   System Development Cost Estimation

We have used Boehm's Constructive Cost Model
(COCOMO) of the software development life cycle to estimate
the costs for the alternatives.   Summary data of development
costs by alternative appear in Table 10.   In order to obtain
a more reliable   estimate of the size and complexity of the
systems being evaluated, they were decomposed into
functional sub-systems.   This follows the guidance for the
Intermediate COCOMO Model [Ref. 12: pp. 147-157].   We
emphasize that the decomposition is generic in nature.   It
is meant only as an estimating tool for the general
functions which the software will perform.   It is not a
design specification in any sense.   The functions could be
rearranged or consolidated with others.   They are used as
general guidelines to aide in estimating attributes of the
software product required.

The differences in costs for Alternatives 1 and
3 versus Alternative 2 stem from the use of personal
computers for program development.   Some applications, such
as smaller database and report generators would not be
developed at all under Alternative 2.   In addition, the
Model portion of Alternative 2 is significantly larger than
than the other two.   This reflects the assumption that
personal computers could be used to perform some of the math
model post processing.

TABLE 10

Summary of COCOMO Cost Estimates

Effort Measures	Alternative		
	1 Distributed	2 Centralized	3 Distributed Network
Development Effort			
Project Schedule in months	8.5	7.5	8.5
Total man months to develop	32	24	32
Delivered Source Instructions	9,500	6,500	9,500
Product Costs (000's) omitted **Cost Per Component**			
PC Applications	$ 35	$ 0	$ 35
Interfaces	28	30	28
Model	87	105	87
Database	39	39	39
Reports	29	14	29
Total Product Cost	$ 218	$ 188	$ 218
Maintenance Effort (000's) omitted			
Annual Maintenance Costs	$ 23.5	$ 18.0	$ 23.5

d. Functional Decomposition

(1) Personal Computer Applications. This is
the portion of the software which will operate only on the
personal computers. It will accept data in files from the
mainframe. It will accept inputs from the user as data
entries and commands entered from the keyboard. It will
perform routine database functions mainly concerned with the
management reports analysis, verification, and production
and storage. This includes arithmetic operations, searches
and sorts of data files to facilitate analysts' routine
tasks. Custom spreadsheet applications would also be
required.

The math programming model required for the
forecast of the overhead accounts will be mostly a mainframe
application. However, as much post-processing as possible
will be done using the personal computers to increase
responsiveness and avoid mainframe operations costs.
Estimates for this portion of the software reflect this
assumption.

(2) Interfaces. This represents the interface
modules between the users and the system, the system and its
host machine operating environment, and the MPBS and any
other software systems with which it will share data. This
also includes interfaces between the major functional
modules of the system such as personal computer-based
portions and mainframe based portions.

(3) Mainframe Model. This is the math
programming model to forecast the T2P2 man year averages and
dollar costs based on the parameters given by the user. It
is expected to be developed to allow user inquiries of the
effects of changes in the model parameters on the level and
composition of the overhead accounts. A clear possibility
for this function is the direct use or adaptation of

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existing manpower models. The extent to which existing code
can be modified or a functioning model's output may be used
will have a significant impact on the cost of providing this
function.[5]

(4) Mainframe Database. This will extract
from the JUMPS/MMS system the required data elements and
transactions in order to build a table of Transient and
Trainee related characteristics. It must have the
capability to be updated based on current actual Transient
and Trainee reporting transactions of the JUMPS/MMS system,
such as a marine's origin, destination, schools information,
years of service, grade, military occupational specialty,
sex, delay and travel time, etc. The model will use this
data to forecast future T2P2 numbers based on present and
planned manpower structure, manning policies and
constraints.

(5) Reports. This is the summarization and
presentation of the results of analysts' queries to the
system. It includes such items as mainframe or personal
computer generated reports and presentation graphics in
hardcopy or magnetic media. It should have the capability
to produce routine reports, and allow users to easily
produce custom report formats for presentation of results of
ad hoc queries and analyses.

e. Mainframe Development Charges

Boehm's estimates for computer use during system
development were used as the basis for this estimate
[Ref. 12: p. 256]. Computer hours are estimated based on
the amount of development effort and the type of computer to
be used. Results of calculations are shown at Table 11.

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[5]The possible impact of the use of existing models or
code is addressed in the Conclusions section of this
chapter.

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Rates are based on the resource accounting
system of a large time sharing system which is not a
candidate for implementation. A complete discussion of this
issue follows below under Mainframe Operations Costs.

3. Recurring Costs

These are costs which will be incurred on a periodic
basis throughout the life of the project. Only those
recurring costs which will differ materially from the status
quo or among each other will be addressed. Cost of
materials and supplies under all alternatives are considered
to be roughly equal.

a. Software Maintenance and Modernization

This covers the personnel costs of maintaining
the system software once it has been developed, installed
and tested. It does not take into consideration major
modifications. It allows for routine, minor modifications
in response to changes in the environment in order keep the
system running in a useful condition. A major consideration
under this aspect is the estimate of the magnitude of change
that the software will experience during the year. This was
estimated with a quantity called the Annual Change Traffic
(ACT) of the components of the software. All components are
estimated to incur a 10 per cent rate of change except those
portions which will interface directly with the JUMPS/MMS
system. These are projected to experience a 15 per cent
rate of change. The COCCMO model results for maintenance
appear in Table 10.

b. Mainframe Operations Costs

Mainframe operating costs are based on two
factors. First, on estimates of computer resource charges
for similar software systems running at CDC Rockville, Md in
a mix of batch and real time modes. Second, they are based

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TABLE 11

COCOMO Estimate for Mainframe Computer Development Charges

	Alternative					
	1		2		3	
	Distributed		Centralized		Distributed Network	
Mainframe Development Costs	Usage	Cost	Usage	Cost	Usage	Cost
Connect Time $9/hr.	440	$ 3,960	580	$ 5,220	440	$ 3,960
Input/Output $40/hr.	8.8	352	11.6	464	8.8	352
CPU Charge $600/hr.	4.4	2,640	5.8	3,480	4.4	2,640
Processor Storage $54/M/hr	4.4	238	5.8	313	4.4	238
On line File Storage $20/connect hr	440	8,800	580	11,600	440	8,800
Total Monthly Charges		$ 15,990		$ 21,077		$ 15,990

on resource charges of another large computing operation [Ref. 13], specifically an IBM computer system at the Naval Postgraduate School, Monterey, CA., operating under VM/CMS and [6] These cost estimates are summarized for each alternative in Table 12.

There are complications in estimating the costs of mainframe operations. First, it is not known at this time where the mainframe portion of the system will be installed. There are two likely sites. Control Data Corporation's Rockville, Maryland time sharing service is used by the Marine Corps for several other manpower models. And the CDPA, Quantico also has the capacity to support the proposed system. Second, it is difficult to estimate costs for timesharing when only a general notion of the size and type of software required can be known at this stage. Finally, the CDPA, Quantico does not have a billing algorithm with which to charge back users for computer resources they use.

To consider the cost of the resources used, a judgement was made to assign an opportunity cost to the use of the Marine Corps computer based on estimates of charges for commercially available time sharing services. No assumption is made to locate the system at particular site. The intent is to assign a cost for resources consumed, whether it is a Marine Corps owned computer or a time sharing service. Resource consumption was extrapolated based on estimates of computer resource usage developed for other related manpower systems developed by Decision Systems Associates, Inc., of Rockville, Maryland [Ref. 11: p. 32]. The usage rates and estimated charges for all three alternatives are summarized in Table 12.

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[6] VM/CMS and MVS are IBM trademarks for conversational and batch mode operating systems.

TABLE 12

Estimated Monthly Mainframe Operations Costs

| | Alternative | | | | | |
| | 1 Distributed | | 2 Centralized | | 3 Distributed Network | |
Mainframe Monthly Costs	Usage	Cost	Usage	Cost	Usage	Cost
Connect Time $9/hr.	25	$ 225	40	360	25	$ 225
Input/Output $40/hr.	0.5	20	0.8	32	0.5	20
CPU Charge $600/hr.	0.25	150	0.40	240	0.25	150
Processor Storage $54/M/hr	1M/.25	14	1M/.4	22	1M/.25	14
On line File Storage $20/connect hr.	25	500	40	800	25	500
Total Monthly Charges		$ 909		$ 1,454		$ 909

c. Recurring Costs Summary

(1) <u>Alternative</u> <u>1</u>. The recurring costs for this alternative are grounded on the assumption that the use of personal computers will allow costs of mainframe processing to be lower. Therefore, costs of operation for this alternative are lower than for Alternative 2. Rates applied are for civilian contractor charges generally charged in the local data processing environment [Ref. 11].

(2) <u>Alternative</u> <u>2</u>. Under this alternative all significant processing is done on a mainframe. Estimates of computer usage are based on estimates for similar systems running at the Control Data Corporation Eastern Computer Center, in Rockville Maryland.

(3) <u>Alternative</u> <u>3</u>. The charges for this system are the same as under Alternative 1. Network software is not expected add any significant costs to system maintenance or operation.

F. BENEFIT ANALYSIS

1. <u>General</u>

We now will discuss the possible benefits to be realized from the implementation of the system. The alternatives do not provide the same level of benefits. Aldditionally, the benefits are not equally important to the user.

To gain more understanding of the relative level of benefits provided by the system, we will use a weighted benefits analysis approach. Each of the benefits that the system will provide will be weighted based on its relative importance. Each alternative will then be judged on the degree to which it can provide a benefit. The product of the benefit weight and the benefit rating yields the alternative's weighted rating for a given benefit.

2. Discussion of Benefits

    a. Increase In Data Reliability

        Increased reliability cf data used in the
preparation of management reports. Data will be extracted,
verified and edited electronically.

        All alternatives offer a significant increase
over the present system. Use of personal computers will
increase the ability to share data among analysts.
Alternative 3 provides the highest level of this reliability
since it will be easier to have access to data possessed by
others. This means that changes or updates to reports or
statistics can be made available to all analysts.
Inconsistency in data may be reduced.

    b. Increase In Data Handling Efficiency

        Increased efficiency in the handling and storage
of data for management reports, budgets, Program Objective
Memoranda (POM), Five Year Defense Plans (FYDP). Data and
reports will be easily stored and retrieved electronically.
Hardcopy reports are reduced to a minimum. Analysts and
supervisors may share, review work and have access to stored
files.

        Alternative 3 provides the means to achieve the
highest efficiency in data handling and storage.
Alternative 2 does not provide a significant improvement in
the means to handle, store and organize the data and reports
used by MPP-40.

    c. Enhanced Physical Security

        Data and reports can be archived on magnetic
media. There will less chance for accidental destruction,

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deterioration or physical damage. Back-up copies may be
stored elsewhere. This will reduce the vulnerability to
loss from physical damage.

d. Increased Productivity

Reduction in the time required to analyze data
and understand the impact of various courses of action on
the Manpower budget through "what if" capabilities in
electronic spreadsheets and model parameters. Historical
data may be searched, retrieved and organized in less time
than in a manual file system.

Personal computing will allow a larger increase
in personal productivity than a mainframe approach. The
ability to access common data, reports, and prepare
correspondence with less manual intervention can be gained
with a network approach. Mainframe processing alone does
not provide as great a benefit.

e. Enhanced T2P2 Estimates

Increase in the reliability of the estimates for
the T2P2 accounts for the FYDP and budgets. Present methods
for estimating and costing T2P2 manyear averages are time
consuming and are less rigorous than desired. T2P2 rates
and averages may be determined from actual elapsed time
reporting in the Manpower Management System.

All alternatives will use a mathematic
programming approach to improve the present methods of
forecasting and budgeting for T2P2 numbers.

f. Increased Analysis Flexibility

Enhanced flexibility will be provided through an
analysis feature for the forecast of T2P2 in the math
projection model which will allow a rigorous approach to the
impact of such changes in force structure, manning, schools,

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and assignment policies. Electronic spreadsheets will allow
many different approaches to be taken in data analysis.

Personal computing will allow analysts to use
custom written programs to aide in preparing reports and
budgets. In addition, the use of electronic spreadsheet and
database applications written by users themselves will allow
an increase in analysis flexibility not available in a
mainframe environment.

g. Decreased Inquiry Response Time

Decrease in the response time for preparing
reclamas or responses to hoc inquiries from senior
Headquarters officials. Wordprocessing, electronic filing,
presentation graphics capabilities will speed the
preparation of briefs and reports.

Personal computing will allow analysts to have
access to data and the ability to prepare reports needed to
answer inquiries and prepare responses to other agencies
requests. This decrease in response time will not be as
significant in a generally less responsive mainframe
environment. Only personal computing offers the office
automation capabilities required to speed the production of
reports through access to computing power.

h. Increase In Morale and Job Satisfaction

Increase in morale and effectiveness of analysts
will be gained from the reduction of repetitive clerical
processing and increases in personal productivity. Analysts
will have time to do more worthwhile tasks.

Improving the quality of data used by analysts
and lessening the burden of repetitious manual editing and
calculation will have a positive impact on the working
conditions and personal satisf ction enjoyed by users. In
general, all alternatives will provide at least a perceived
increase in productivity and efficiency.

3. Benefit Ratings

The benefits discussed above were quantified with ratings reflecting their relative merit and desirability. A rating of twenty indicates the highest desirability or importance and a rating of five reflects the lowest relative importance. The alternatives were then judged on how well each satisfied the benefit. A weighted score was then calculated for each benefit by multiplying the weight of each benefit and its benefit score. The weighted scores were then summed over all benefits for each alternative to arrive at a Total Weighted Score. The results of these computations are shown in Table 13.

The results of this analysis yield the following scores:

Alternative 1	1055
Alternative 2	840
Alternative 3	1200

G. COMPARISON OF ALTERNATIVES

The alternatives have been found to have unequal benefits and unequal costs. Because of this, a benefit/cost ratio was computed for each alternative based on the results of the costs and benefit calculations [Ref. 8].

TABLE 13

Benefit Analysis Summary

Benefit	Relative Weight	Score Alt 1	Alt 2	Alt 3	Weighted Alt 1	Alt 2	Alt 3
INCREASE IN DATA RELIABILITY	20	8	7	10	160	140	200
INCREASE IN DATA HANDLING EFFICIENCY	20	7	5	10	140	100	200
ENHANCED PHYSCIAL SECURITY	10	10	10	10	100	100	100
INCREASED PRODUCTIVITY	15	7	5	10	105	75	150
ENHANCED T2P2 ESTIMATES	20	10	10	10	200	200	200
INCREASED ANALYSIS FLEXIBILITY	15	10	5	10	150	75	150
DECREASED INQUIRY RESPONSE TIME	10	10	7	10	100	70	100
INCREASE IN MORALE, JOB SATISFACTION	10	10	10	10	100	100	100
TOTAL					1055	860	1200

The present values of the estimated life cycle costs for the three alternatives are presented in Table 15. Alternative 2 has the lowest costs on a present value basis of the alternatives. The difference between the high and low costs is $28,969, a variance of approximately 7 per cent.

To provide a consistent method of comparing costs for the alternatives, a quantity known as Uniform Annual Costs was computed [Ref. 8: p. 11-1]. First, the present value of the life cycle costs is discounted at 10% over a five year economic life. See Table 15. Next, the present value cost is divided by the cumulative series present value factor used to calculate the discounted life cycle cost. The resulting Uniform Average Cost is an average annual cost which takes into consideration the time value of the stream of costs associated with the alternative. Finally, the quantified benefits of each alternative are divided by the Uniform Annual Cost for each. The result is a discounted benefit to cost ratio. For the base case these calculations are shown in Table 14.

Alternative 3 was found to have the highest benefit to cost ratio using discounted costs over a five year life. The variance between the high and low ratios was a differential of 19 per cent.

H. SENSITIVITY ANALYSIS

The purpose of sensitivity analysis is to determine the affect of changes in underlying assumptions on the results which were obtained above. It indicates the resistance of our analysis against errors in estimation, bias, defects in our modelling techniques, and unexpected changes in the economic and technical environment in which the system will be developed and maintained.

TABLE 14

Benefit Cost Ratio Calculations

Alternative	UAC	BCR
Alternative 1	99,969	1.06
Alternative 2	89,876	0.96
Alternative 3	100,790	1.19

$$\text{Uniform Annual Cost} = \frac{\text{Present Value Cost}}{\text{Cumulative Discount Factor}}$$

$$\text{Benefit Cost Ratio} = \frac{\text{Weighted Benefits}}{\text{Uniform Annual Cost}} \times 100$$

A sensitivity analysis was conducted to determine the affect of certain changes on the results obtained above. The following changes were introduced into the analysis:

1. Reduction in the number of workstations from four total to two.

2. An decrease in the size of the software product required of 15, 25 and 50 per cent.

1. Reduction of Hardware Costs

The number of workstations purchased for all alternatives was reduced by 50%. Accordingly, a 50% reduction in hardware and software purchase costs is realized. This shows the sensitivity of the results to changes in hardware costs and configurations. See Table 16 for the results of these calculations. The lowest cost alternative here remains Alternative 2. However, the costs begin to converge slightly in real terms. The difference between the high and low costs is now $22,288 (down from $29,000), a spread of 6%. On a cost/benefit basis, Alternative 3 still provides the highest level of benefits

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per discounted dollar cost. Here the differential between high and low BCR is 26%. This is not significantly different than the base case.

2. Reduction of Software Costs

The size of the software product required was reduced for all alternatives by 15, 25 and 50%. This also reduced the maintenance costs by the same amounts. The results of these changes are shown in Tables 17 through 19. Alternative 3 always had the highest level of benefits per discounted dollar of cost. Alternative 2 was the lowest cost for all cases.

I. CONCLUSIONS

Under all cases of sensitivity analysis, Alternative 3 produces the highest level of benefits, and the highest benefit to cost ratio. Alternative 3 is also the most expensive to implement. Figure 5.1 illustrates the relative levels of costs and benefit to cost ratios for all alternatives from the base case through a 50% reduction in software development costs. We note that as project costs decrease, the benefit to cost ratics increase.

As project costs decrease, there is a tendency for costs of the alternatives to ccnverge. Put another way, as the project gets smaller and cheaper there is less of a difference in cost. This is illustrated in Figure 5.1 by the data points grouping around a cost level as the benefit to cost ratios increase.

In our original estimates, the costs associated with building the model to predict the T2P2 rates were based on a separate, complete development effcrt for a large, complex math programming model.

TABLE 15

Total Present Value Costs

Present Value Analysis

DISCOUNTED ANNUAL COSTS

COST CATEGORY	FY 0	FY 1	FY 2	FY 3	FY 4	FY 5	TOTAL DISCOUNTED COST
Undiscounted Costs							
Alternative 1	259,392	34,408	34,408	34,408	34,408	34,408	431,432
Alternative 2	216,427	35,448	35,448	35,448	35,448	35,448	393,667
Alternative 3	263,967	34,408	34,408	34,408	34,408	34,408	436,007
Present Value Factor	1.0	.954	.867	.788	.717	.652	.592
Discounted Costs							
Alternative 1	259,392	32,825	29,832	27,114	24,671	22,434	396,268
Alternative 2	216,427	33,817	30,733	27,933	25,416	23,112	357,438
Alternative 3	263,967	32,825	29,832	27,114	24,671	22,434	400,843

TABLE 16

Sensitivity Analysis
Case 1

COST ELEMENT	REDUCE HARDWARE/SOFTWARE PURCHASE BY 50%						
	FY 0	FY 1	FY 2	FY 3	FY 4	FY 5	TOTAL COST
Undiscounted Costs							
Alternative 1	246,691	34,408	34,408	34,408	34,408	34,408	418,731
Alternative 2	212,752	35,448	35,448	35,448	35,448	35,448	389,992
Alternative 3	248,979	34,408	34,408	34,408	34,408	34,408	421,019
Discount Factor	1.0	.954	.867	.788	.717	.652	
Discounted Costs							
Alternative 1	246,691	32,825	29,832	27,114	24,671	22,435	383,566
Alternative 2	212,752	33,817	30,733	27,933	25,416	23,112	353,764
Alternative 3	248,979	33,825	29,832	27,114	24,671	22,435	385,857
Benefit Cost Ratio							
Alternative 1	1.09						
Alternative 2	0.97						
Alternative 3	1.24						

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TABLE 17

Sensitivity Analysis
Case 2

15% REDUCTION IN SOFTWARE DEVELOPMENT COSTS

	FY 0	FY 1	FY 2	FY 3	FY 4	FY 5
Discount Factor	1	0.954	0.867	0.788	0.717	0.652
Alternative 1						
Annual Cost	226,692	30,883	30,883	30,883	30,883	30,883
Cumulative Cost	226,692	257,575	288,458	319,341	350,224	381,107
Discounted Cost	226,692	29,462	26,776	24,336	22,143	20,136
Cumulative Discount	226,692	256,154	282,930	307,266	329,409	349,545
Alternative 2						
Annual Cost	188,227	32,748	32,748	32,748	32,748	32,748
Cumulative Cost	188,227	220,975	253,723	286,470	319,219	351,967
Discounted Cost	188,227	31,242	28,393	25,800	23,480	21,352
Cumulative Discount	188,227	219,469	247,861	273,667	297,147	318,499
Alternative 3						
Annual Cost	231,267	30,883	30,883	30,883	30,883	30,883
Cumulative Cost	231,267	262,150	293,033	323,916	354,799	385,682
Discounted Cost	231,267	29,462	26,776	24,336	22,143	20,136
Cumulative Discount	231,267	260,729	287,505	311,841	333,984	354,120

Benefit Cost Ratio

Alternative 1	1.19
Alternative 2	1.07
Alternative 3	1.35

TABLE 18

Sensitivity Analysis
Case 3

25 % REDUCTION OF SOFTWARE DEVELOPMENT COSTS

	FY 0	FY 2	FY 3	FY 4	FY 4	FY 5
Discount Factor	1	0.954	0.867	0.788	0.717	0.652
Alternative 1						
ANNUAL COST	204,892	28,533	28,533	28,533	28,533	28,533
CUMULATIVE COST	204,892	233,425	261,958	290,491	319,024	347,557
DISCOUNTED COST	204,892	27,220	24,738	22,484	20,458	18,604
CUMULATIVE DISCOUNT	204,892	232,112	256,851	279,335	299,793	318,396
Alternative 2						
ANNUAL COST	169,427	30,408	30,403	30,408	30,408	30,408
CUMULATIVE COST	169,427	199,835	230,243	260,651	291,059	321,467
DISCOUNTED COST	169,427	29,009	26,364	23,962	21,803	19,826
CUMULATIVE DISCOUNT	169,427	198,436	224,800	248,761	270,564	290,390
Alternative 3						
ANNUAL COST	209,467	28,533	28,533	28,533	28,533	28,533
CUMULATIVE COST	209,467	238,000	266,533	295,066	323,599	352,132
DISCOUNTED COST	209,467	27,220	24,738	22,484	20,458	18,604
CUMULATIVE DISCOUNT	209,467	236,687	261,426	283,910	304,368	322,971

Benefit Cost Ratio

ALTERNATIVE 1	1.31
ALTERNATIVE 2	1.18
ALTERNATIVE 3	1.48

1·0

2·8

2·5

5·0 3·15

2·2

3·5

1·1

4·0

2·0

4·5

1·8

1·25 1·4

1·6
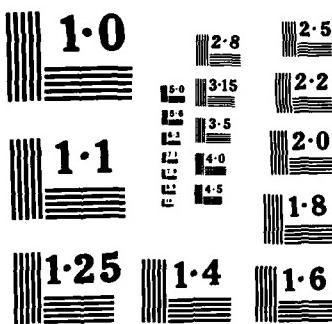
NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

TABLE 19

Sensitivity Analysis
Case 4

50% REDUCTION IN SOFTWARE DEVELOPMENT COSTS

	FY 0	FY 1	FY 2	FY 3	FY 4	FY 5
Discount Factor	1	0.954	0.867	0.788	0.717	0.652
Alternative 1						
ANNUAL COST	150,392	22,658	22,658	22,658	22,658	22,658
CUMULATIVE COST	150,392	173,050	195,708	218,366	241,024	263,682
DISCOUNTED COST	150,392	21,616	19,644	17,855	16,246	14,773
CUMULATIVE DISCOUNT	150,392	172,008	191,652	209,507	225,753	240,526
Alternative 2						
ANNUAL COST	122,427	26,448	26,448	26,448	26,448	26,448
CUMULATIVE COST	122,427	148,875	175,323	201,771	228,219	254,667
DISCOUNTED COST	122,427	25,231	22,930	20,841	18,963	17,244
CUMULATIVE DISCOUNT	122,427	147,658	170,589	191,430	210,393	227,637
Alternative 3						
ANNUAL COST	154,967	22,658	22,658	22,658	22,658	22,658
CUMULATIVE COST	154,967	177,625	200,283	222,941	245,599	268,257
DISCOUNTED COST	154,967	21,616	19,644	17,855	16,246	14,773
CUMULATIVE DISCOUNT	154,967	176,583	196,227	214,082	230,328	245,101

Benefit Cost Ratio

| ALTERNATIVE 1	1.64
ALTERNATIVE 2	1.41
ALTERNATIVE 3	1.85
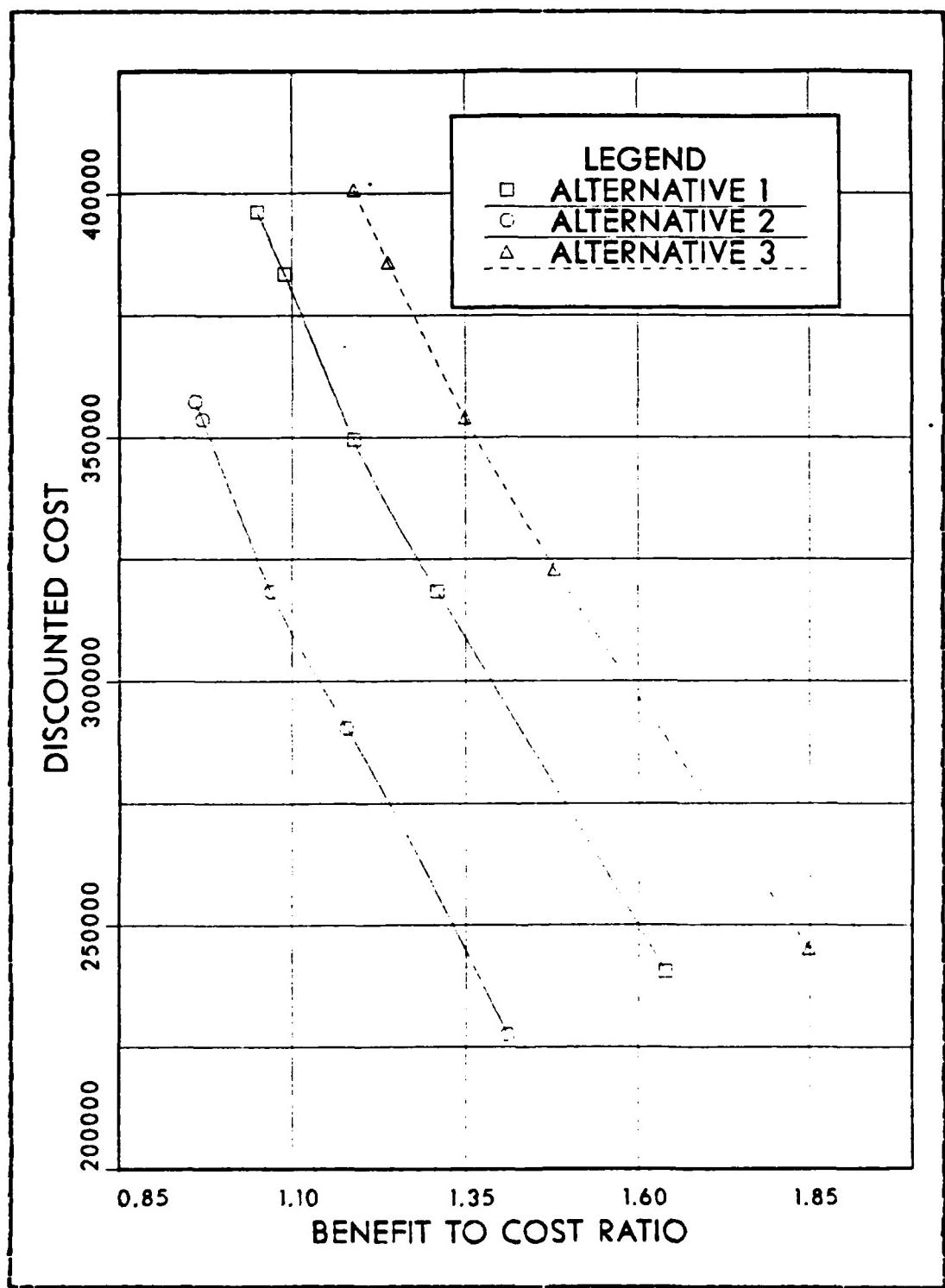
Figure 5.1   Cost Benefit Analysis

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It is likely that a large part of the model's functions may
be directly adapted from existing manpower systems
(Transient Flow Model, Officer and Enlisted Planning
Systems). If this is the case, the project will tend to
look more like sensitivity case 3 or 4 (the lower end of the
graph in Figure 5.1), because less custom built software
will be required. This means that the cost differences
between the alternatives will tend to lessen as overall
project costs decrease. The actual level of benefits
provided will remain the same as in the base case. So, the
marginal rate of return on investment (as measured by the
benefit cost ratio) grows as project size decreases.

This finding from the model of the project which we
built using the COCOMO method is supported in [Ref. 16]. In
it DeMarco argues that there are decreasing returns to scale
in software projects in general. Simply reducing the size
and scope of a project causes a significant decrease in the
cost.

J. RECOMMENDATIONS

Under the conservative assumptions of the base case
(large software product size) Alternative 3 presents the
highest level of benefits at the greatest cost. An
overriding consideration is the level of confidence which we
can place in our estimate of software product cost. At this
early stage, there is uncertainty in the size of the
software product required. Boehm [Ref. 12: p. 310] argues
that early in the life cycle cost estimation errors tend to
vary by a factor of four on either the high or low side of
the actual cost. As we move into the project and gather
more knowledge about the requirements of the software, we
begin to narrow our estimating error. He maintains that by
the time the feasibility study phase is completed, there

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should be approximately a factor of two error in our
estimate. Figure 5.2 [Ref. 12: p. 311] illustrates the
great variability of cost estimates in the early stages of
project development. Clearly, we are at a point near the
origin of the graph in Figure 5.2 where the variability of
estimates is still comparitively high.
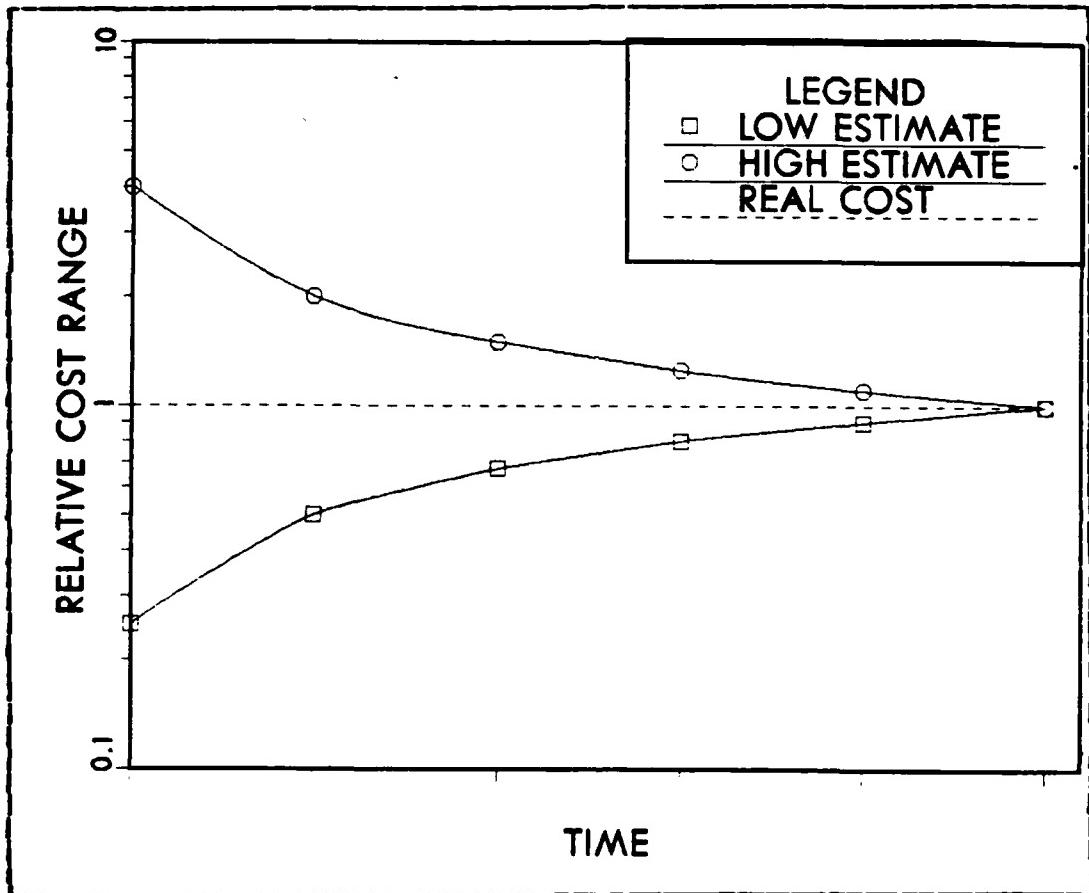
Figure 5.2   Software Cost Estimation Accuracy Versus Time

Through sensitivity analysis, we have shown software
costs have a major impact on project cost. We should
consider a range of possible outcomes. There is a strong
possibility that the actual size of the project will be much

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smaller due to the availability of existing and developing
manpower systems software. If this is the case, then the
recommendation is Alternative 3, based on the premise that
it provides a superior level of benefits for a small
increase in cost over the other alternatives.

VI. CONCLUSION

A. ANALYSIS OF METHODOLOGY

The life cycle management procedures that are prescribed by the Department of Defense have changed little in the past five years. The methods prescribed were tailored for the analysis and procurement of large systems dominated by hardware costs. The microcomputer explosion of the past three to five years has changed the way users see their information needs. As we have seen in this study, there is a need for user-responsive, flexible information processing. While a large portion of the processing is clearly adapted to mainframe processing, there are significant needs which can only be met with personal computing and office automation.

In the case where an automated solution clearly involves microcomputers, the development process is the same for a mainframe batch-oriented system. [Ref. 2] encourages the analyst to address interface issues in system design, but only since the widespread use of microcomputers has this gained importance. Users want to share data. They also want to avoid what they view as wasteful, inflexible and unresponsive centralized information processing support. As microcomputers become more and more powerful, they are playing an increasing role in the solution of information processing problems. The obvious result is the proliferation microcomputers.

However, nowhere in Department of Defense Life Cycle Management for Automated Information Systems directives are the unique problems of system design and system management and integration with microcomputers addressed. As more and

more distributed and office automation systems evolve, the
Marine Corps faces challenges in attempting to fully exploit
the benefits of the disparate systems which exist in various
user organizations.

B. RECOMMENDATIONS

1. Strategy

The methodology prescribed by [Ref. 2] is a
structured approach. It uses an iterative design technique
where user needs are identified and solutions are proposed
at increasing levels of detail as the project moves through
the approval milestones. Clearly, such a controlled
approach is well suited to the corporate culture of a
military headquarters staff where clear consensus and
concurrance is required. It might be argued that the
staffing approach used by military organizations, in
general, tends to ameliorate the tendency to produce systems
of extremely narrow focus, since often those persons who
will not be direct users of the system must give their
concurrance as the system passes through approval
milestones. This encourages the consideration of wider
issues such as information sharing across organizational
bounds and duplication of effort.

However, the advantage gained from having control
over the development process also leads to certain
disadvantages. The process generally starts with a user
identifying a deficiency in the way business or processing
is done. Analysis and possibly design of a system to
correct the deficiency then begins. The controls within the
process (the requirements of [Ref. 2]) require that
interfaces, inputs and outputs be carefully defined. This
does encourage a wide perspective cf the problem.

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The problem lies in the nature of the origin of the initial request. It is a reaction to a perceived problem. Corrective action is taken and the process begins anew when another problem is identified. A more reasoned approach would be to attempt to actively identify information processing needs before they become clear hindrances to mission performance. In effect, a proactive versus reactive approach.

A wide view needs to be taken in the design of systems. Solving individual problems can paradoxically result in being saddled with many successfully implemented solutions which are not well integrated from the perspective of the overall information needs of the organization. The result is a fragmented information system and a sense of frustration over lack of coherence and usefulness.

Dr. William Zani defines the problem succinctly:

"Traditionally, management information systems have not really been designed at all. They have been spun off as by-products while improving existing systems within a company. No tool has proved so disappointing in use. I trace this disappointment to the fact that most management information systems have been developed in the "bottom-up" fashion--an effective system, under normal conditions, can only be born of a carefully planned, rational design that locks down from the top, the natural vantage point of the managers who use it." [Ref. 17]

One approach to address this problem is the Business Systems Planning methodology developed by IBM [Ref. 18]. It is similar to other analysis approaches which take a wide perspective of the management of information. The key element of the approach is the involvement of top management in the development of a rational Information Resource Management Plan. This is in contrast to reactively solving problems as they arise. An information plan allows the organization to identify and prioritize problems and solutions of Information Resource Management.

Clearly, the Marine Corps is a plans oriented
organization. Systematic planning is imperative in
amphibious warfare. It seems reasonable to propose that the
Corps begin now to plan the information systems it needs to
carry out the business of administering the headquarters
functions. There are several systems currently under
development which attempt to address information needs of
the entire Marine Corps. However, there is no information
management plan for the unique and critical functions of the
Headquarters organization itself.

2.   Present Methods

Despite the inherent tendency for the presently used
methodology to promote less integration, the system managers
and designers all expressed the view that information
sharing and integration need to be stressed as much as
possible. Because of this emphasis, systems under
development do attempt to address the issues of
inter-departmental information sharing and responsibilities
and future interface requirements. Given the acceptance of
these issues, a methodology which encourages more top level
planning can clearly provide even a better return of more
useful systems to support the information needs of the
Marine Corps.

APPENDIX A
GLOSSARY OF TERMS

Five Year Defense Plan (FYDP. A document which among other things, contains the military manpower listing displaying the gross end-strength number of authorized manpower for the Marine Corps. The FYDP is updated monthly to reflect the ongoing policy decisions made by the Marine Corps which affect manpower levels.

Headquarters Master File (HMF). A subsect of the data contained in MMS. It contains summaries and statistics about the data in MMS.

Manpower Management System (MMS). MMS is the Marine Corps personnel database. It contains all personnel records of marines and all personnel transactions.

Manpower Plan. Produced by MPP-20 and Mpp-30, the Manpower Plan details the losses and gains by month of officer and enlisted populations.

(MP,MC). Military Personnel, Marine Corps. A category of fund accounting covering military compensation.

MPP-20. Enlisted Plans Section.

MPP-40. Officer Plans Section.

MPP-40. Manpower Plans Programs and Budget Section.

Officer Planning System. An automated information system currently under development that will enable the Officer Plans Section (MPP-30) to manage the officer force structure over a seven year planning horizon.

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Permanent Change of Station (PCS). The transfer of a marine
or a unit from one permanent station to another. PCS moves
include :

> Assignment from home or place from which ordered to
> active duty, to the first station upon appointment,
> call to active duty, enlistment, or induction; and
> from the last duty station to home or to the place
> from which the marine entered the service, placement
> on the temporary disability retirement list, release
> from active duty or retirement.

Troop List. A seven year array of the unit structure of the
Marine Corps created by HQMC for planning programming, and
budgeting purposes. Data includes the unit number, unit
structure and totals for officer and enlisted billets, and
values for the manning levels of those units.

Transient Flow Model. A model used by the Officer and
Enlisted Plans Sections to forecast the amount of manyears
required for the Transient category of the overhead
accounts. It does not contain information about budget data
and dollar costs of either transients or the other
categories of T2P2.

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